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ABSTRACT

Presented is a teacher's guide to an elementary science unit designed for use with fourth grade, or higher, students in the Trust Territory of Micronesia. Although there is a degree of similarity to curriculum materials developed for the Science Curriculum Improvement Study, this Micronesian unit does not purport to be an adaption or edition of the SCIS materials. Designed to be taught in the vernacular language, this unit was prepared to be a companion unit to one concerning relative position and motion, with the two units involving the entire school year. The activities are designed for active student participation with the teacher acting as a guide. The unit involves the concepts of environment, environmental factor, range, and optimum range and the processes of observing, communicating, predicting, inferring, and recording. The guide contains information concerning objectives, teacher and student activities, rationale for the various activities, needed materials, teaching suggestions (provided on a day by day basis), and questions to be posed in class discussions. (PEB)

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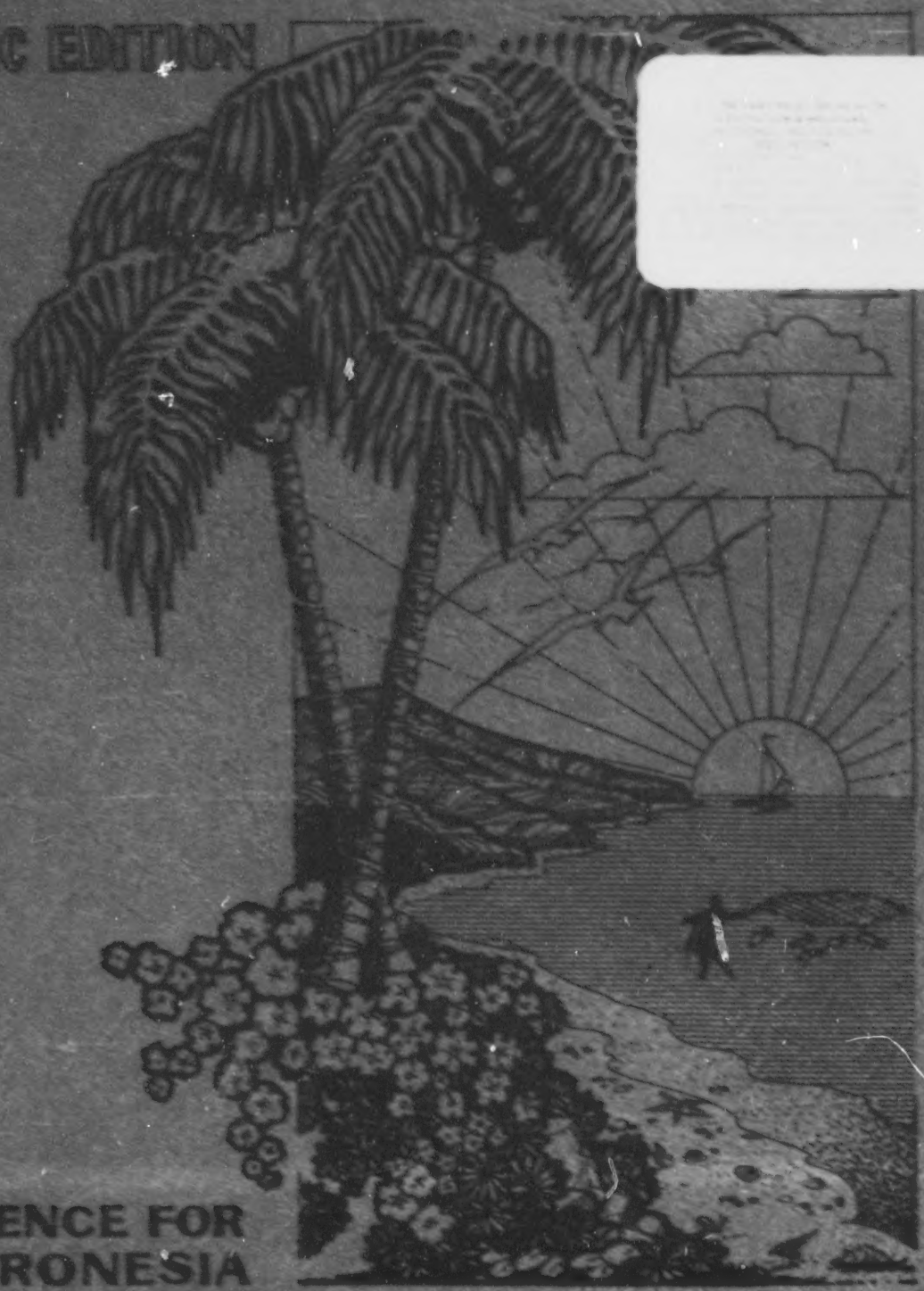
ENVIRONMENTS

BASIC EDITION



SCIENCE FOR MICRONESIA

SE 017 211

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"SCIENCE FOR MICRONESIA"

ENVIRONMENTS - Basic Edition

The teaching concepts utilized in this unit have been adapted from similar programs currently in use in the United States, Africa and other areas of the world. This unit has been adapted for use here by teachers and science educators in the Trust Territory who have considered the local environment, language, educational structure, local materials and culture.

It has gone through the following process:

1. Adapted by Education Specialist/Science-Ponape District as part of an N. D. E. A. Title III project. Experimental teaching done in Ponape district classrooms. Trial Edition printed in May 1972. Assistance in adaptation given by Science Instructors at C. C. M.

2. Trial Edition used in district classrooms on a pilot basis from May 1972 until February 1973. Feedback on the unit was gathered at the February 1973 Trust Territory wide science conference.

3. Basic Edition printed in May 1973. Rewritten and printed under the coordination of the Curriculum Task Force as part of the E. S. E. A. Title III "Elementary Science Improvement Project".

CURRICULUM TASK FORCE

Coordinator - Education Specialist/Science-Trust Territory Dept. of Educ.

Staff - P. C. V. science co-teachers/Marianas District
Curriculum Writer/Trust Territory Dept. of Educ.
Clerk Typist/Trust Territory Dept. of Educ.

Feedback and Research-Elementary teachers from the districts
District Education Specialists/Science
Assistant District Education Specialists/Science
Community College of Micronesia/Science Dept.

Illustration - Felipe Figueroa
Douglas Rankin

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WORDS FOR THE TEACHER ABOUT ENVIRONMENTS

What grade is it to be used at? It is designed to be used in the fourth grade, but it could be used in any of the upper grades.

What language should be used to teach it? Most of the lesson should be taught in the vernacular. You will have to use some English words like "environment" and others not found in the vernacular.

How long will this unit ENVIRONMENTS take? If you use this unit with the unit RELATIVE POSITION AND MOTION it will be enough material for more than a school year. You should use the two units ("RELATIVE POSITION AND MOTION" and "ENVIRONMENTS") so that you do one unit for a while and then switch back to the other unit. For example: start the terrarium experiment in "ENVIRONMENTS" and then do some activities from "RELATIVE POSTION AND MOTION" while you are waiting for the terrarium to change.

You may do the unit "RELATIVE POSITION AND MOTION" before you start on any other unit if that is the way you want to do it. The choice is up to you. This unit should take over half a year to complete.

What kind of science is this? In this science program the children do science activities. We call this "sciencing". Instead of "reading about" science the children "do" science. They "do" science with things found around them and with some new materials supplied in the science kit.

What does the teacher do in class? The teacher should act as a guide. You should guide the students to find answers themselves instead of telling them the answers. To be a good guide the teacher must: ask inquiry type questions, listen to the students, let the students find their own answers.

How fast should the activities be done in class? The unit gives some suggestions for time. Many activities will take more time than suggested if the students are interested in doing other things having to do with the activity. Don't rush the students. It is better to do the activity well than to rush through it.

Does this unit, ENVIRONMENTS, have special things it teaches? Yes, the activities in the unit are designed to let the children do activities that develop or continue to develop the big ideas (concepts) of:

environment	range
environmental factor	optimum range

This unit gives the children opportunities to develop skills that are used in sciencing. For example the skills of: observing, communicating, predicting, inferring and recording.

This unit should be taught in a way that encourages children to think for themselves, become more responsible for their own learning and gain confidence in themselves.

How do I evaluate the students in the class? The education department will give you "narrative evaluation" forms to use. On these forms you can evaluate how your students are doing in many different areas.

Is this kind of science harder to teach? You must be prepared. It will be harder if you do not know what you are doing. To prepare the teacher, workshops are given and these units are written to make the teaching directions easy to understand.

Instead of using your time grading papers, making tests and filling out lesson plans you will now use it in preparing materials. It should not take any more time than with the old science program, if you were properly prepared when you taught the old science program.

It should be easier to plan for because the units are lesson plans that tell you what to do and what materials you need to do it.

It should be easier to teach because you will be supplied with most of the materials needed for the lessons.

It should be easier to teach because it is interesting to you and the children.

The hardest part of teaching this kind of science is for you to learn to be a guide instead of always telling and showing.

What about the materials? Some materials (a kit) will be given to you at the beginning of the school year. Some materials will be collected by the students or by the teacher. All the living organisms will be collected by the students.

The teacher gets the materials kit by asking the Science Program Area at District Education. When you have the materials you are responsible for them and will be expected to pay for any that are lost.

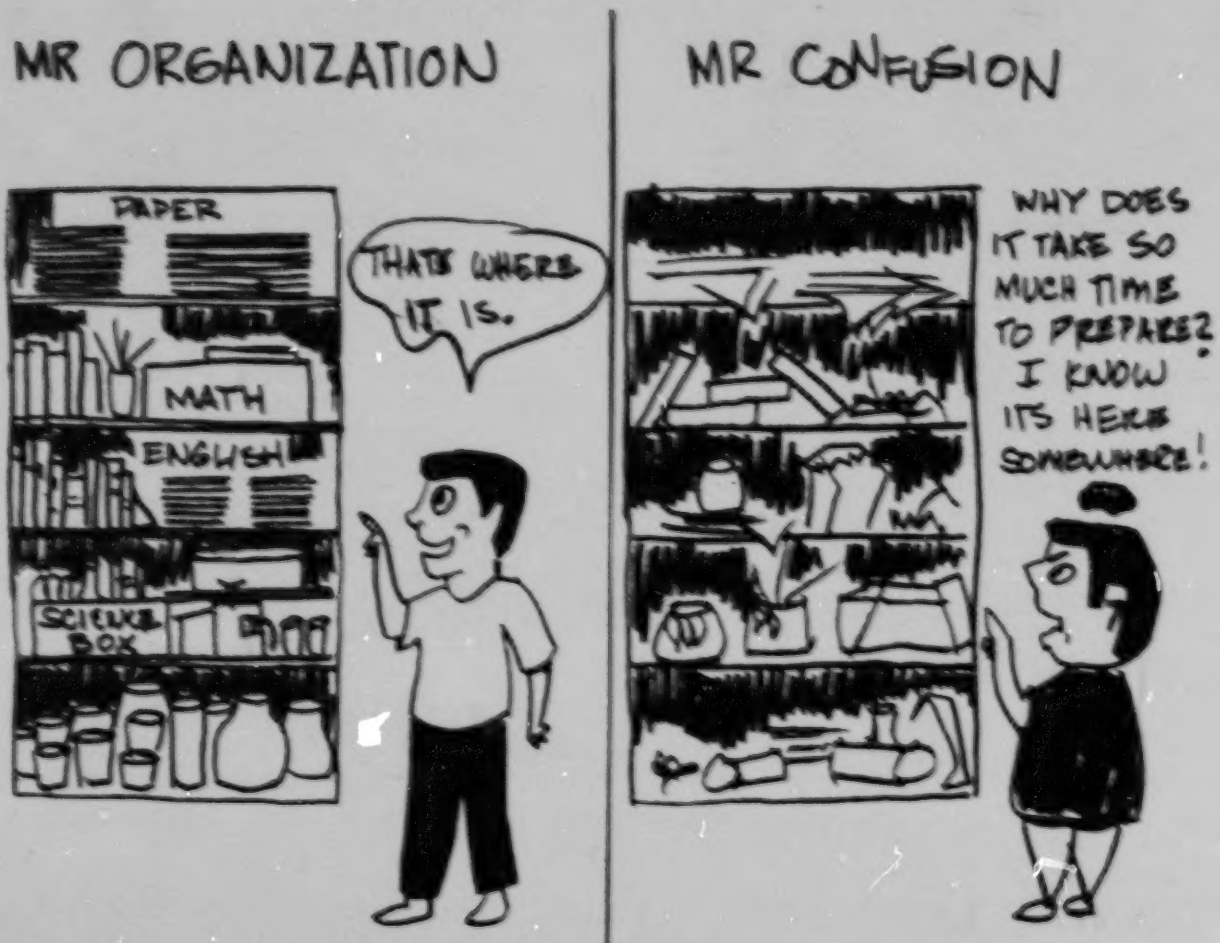
Is this kind of science used anywhere else? Yes, the teaching concepts used in this unit were adapted from similar programs now used in the United States, Africa, Papua and other areas of the world. This unit has been adapted for use here by teachers and science educators in the Trust Territory. They have considered the local environment, language, educational structure, local materials, and culture. The program is now being used in all of the districts in some way. All teachers who now graduate from the Community College of Micronesia are prepared to teach "Science For Micronesia".

How does this unit, "ENVIRONMENTS", fit with the other units?

Below is a diagram showing all the units in grades one through six.

SCIENCE FOR MICRONESIA

PHYSICAL SCIENCE UNITS	LIFE SCIENCE UNITS
Material Objects	Organisms
Interaction And Systems	Life Cycles
Systems And Variables	Populations
Relative Position And Motion	ENVIRONMENTS
Energy Sources	Communities
Models: Electrical And Magnetic Interaction	Ecosystems



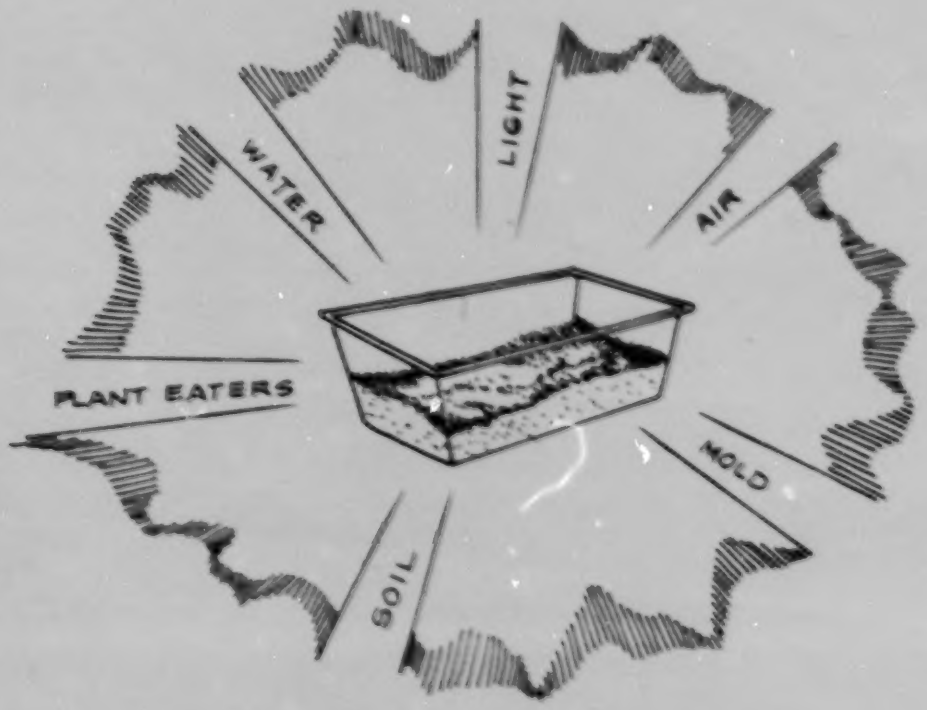
PART 1

AN ORGANISM'S ENVIRONMENT

OBJECTIVES (WHERE PART ONE IS GOING)

At the end of Part One the students should be able to:

- Identify environmental factors that affect organisms living in a terrarium.
- Describe the environments of organisms.



ACTIVITY 1 A PLACE TO LIVE

SYNOPSIS (WHAT WILL YOU BE DOING?)

The students set up terrariums. They try to make the terrarium a good place to live. They take care of and observe the organisms in the terrariums for nine days. During this time they record the populations on a chart. They use their observations and the chart to see changes that take place.

OVERVIEW OF THIS ACTIVITY (WHY ARE YOU DOING THIS?)

This is a hands-on, experience activity leading to the concepts of environment and environmental factor. The students control their own terrariums and observe changes. Later, in Activity 2, they will discuss what affected the organisms in the terrariums and caused the changes.

Be sure you and the students understand that this terrarium should be the best one the students can set up by themselves.

MATERIALS

For each student:
- "What Is In My Place To Live" worksheet

For each group of four students:
- terrarium with lid
- four bean seeds
- four radish seeds
- four corn seeds

(you may substitute local seeds for any of these)

For the class:
- masking tape
- four cans for water
- chart paper
- some cans, jars or bags for collecting animals in

TEACHING SUGGESTIONS

First Day-Making "A Place To Live"

1. Show the class an empty terrarium. Say:

> "This is a place to live for organisms. This is a place to live that can be observed in the classroom."

"What would you put in the terrarium to make it a place to live for some plants? Can you make a good place to live for plants?"

Let the class discuss what they would put in the terrarium and where they would get the soil.

2. Show the class the seeds you have. Say:

"You can plant these seeds."

"You can get seeds from outside or from home to plant."

3. Divide the class into groups of four students each.

Each group will decide how to set up their terrarium to make it the best place to live for plants. Be sure the class understands this. This is the purpose of the activity. The students must understand they are not just setting up another terrarium. They are setting up the best terrarium they can.

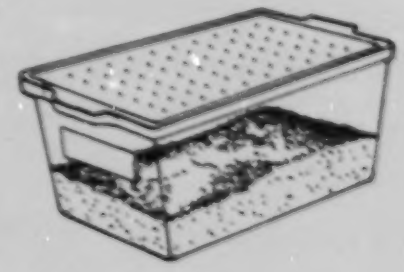
Give each student a "What Is In My Place To Live" worksheet. The students should record the seeds they plant on this worksheet.

Give each group a terrarium and lid. Give each group four bean seeds, four radish seeds and four corn seeds.

4. Let each group go outside and get their soil and other seeds they want to plant.

Let each group set up their place to live (terrarium).

Let each student fill in the top part of his worksheet.



5. Give each group a piece of masking tape. Let each group label the terrarium with their names and the date.

6. Let each group decide where to place its terrarium in the room.

Second Day, Third Day, Fourth Day-Observing The Terrarium

1. On each of these days let the groups observe their terrariums for change.

   The observations may only take ten minutes each day.

2. Let the students take care of their terrariums any way they want. Let them decide if water is needed and where to place the terrariums.

Fifth Day-Putting Some Animals In The Terrarium

1. Tell the class that now they can add some animals to their place to live.

   They can decide what animals to add, but they must follow these rules:

   no animal can be over an inch long,

   there must be four kinds of animals, and

   there cannot be more than ten animals in a terrarium.

   Be sure the groups understand these rules.

2. Each student should look at the bottom part of the "What Is In My Place To Live" worksheet. Explain that this is the place to record the animals they put in their terrariums.

3. Let the groups pick up some jars, cans or bags to collect their animals in.

   Take the groups outside to find the animals for their terrarium.

4. Let each group put the animals in their terrariums and fill in the worksheet.

Sixth Day-Counting The Populations In The Terrariums

1. Let each student take out their "What Is In My Place To Live" worksheet.

2. Put the chart paper on the wall.

   Let one student from each group report the kinds of organisms that are in its terrarium. List the names of the organisms on the chart. Put down each organism's name only once.

For example:

bean
radish
corn
ngas
tangan tangan
ant
hermit crab

3. Let each group get its terrarium.

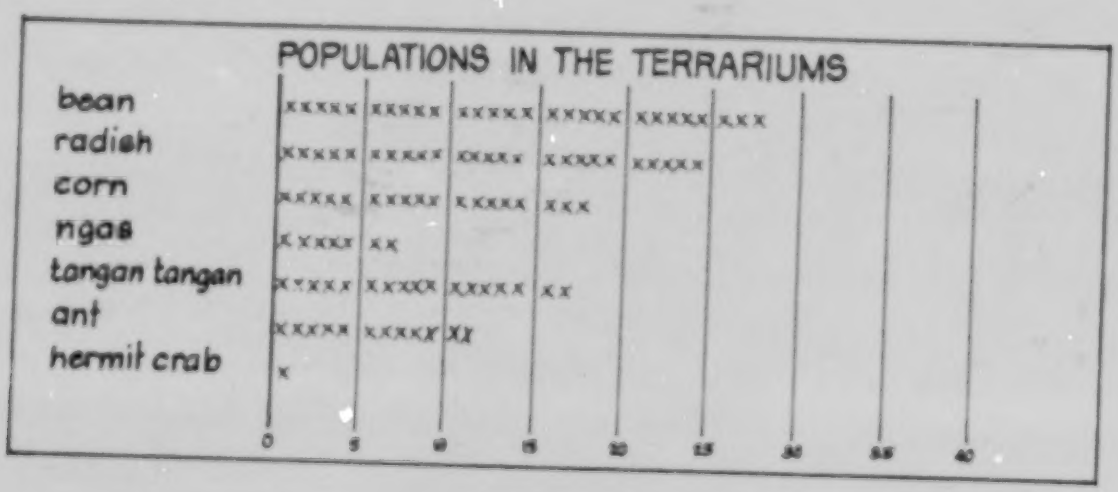
   Let the students observe the terrariums and count the populations.

4. Write POPULATIONS IN THE TERRARIUMS on the chart.

   Ask one student from each group to report the population for each organism now in the terrarium. Only count the animals they can find and the plants that are now growing from the seeds.

   Put the population counts on the chart by making an X for each organism.

For example:



When the chart is complete, it should show the population of each kind of organism in all the terrariums together.

5. Discuss: "Which populations are the largest?"

"Will the populations be the same tomorrow? Why? Why not?"

"Are the populations the same as the day you put them in the terrariums?"

"Did all the seeds come up (germinate)? Do you think they will?"

"Will the animals need food?"

"Why do you put water in your terrarium?"

Seventh Day, Eighth Day, Ninth Day-Observing The Terrarium

1. On each of these days let the groups observe their terrariums for change.

   The observations may only take ten minutes each day.

2. Let the students take care of their terrariums any way they want. Let them decide if water is needed, where to place the terrariums, and if food is needed for the animals.

Tenth Day-Environmental Factors

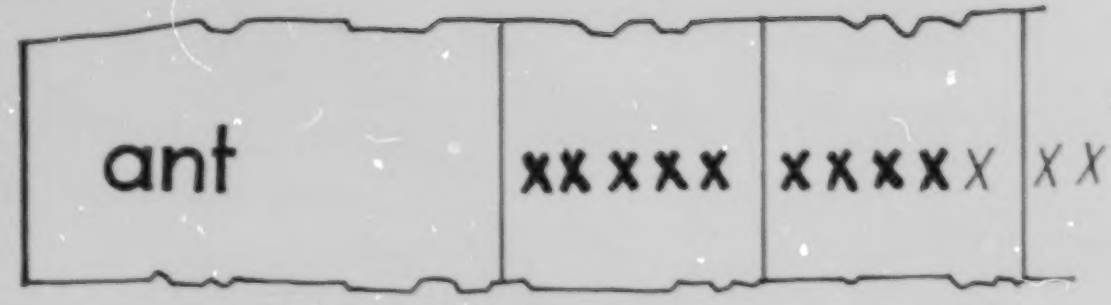
1. Let each group get its terrarium.

   Let the students observe the terrariums and count the populations.

2. Ask one student from each group to report the population for each organism now in the terrarium. Only count the animals they can find and the plants that are now growing.

   Put the population counts on the chart by marking over the Xs with a different color marker. This will show if the populations changed.

For example:



3. Have a class discussion:

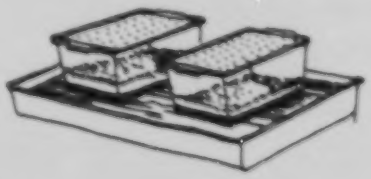
"Which populations changed?"

"Did the populations go up or down?"

FOR THE NEXT LESSON DO ACTIVITY 2 "INVENTING ENVIRONMENTAL FACTORS AND ENVIRONMENT". DO IT TOMORROW IF POSSIBLE.

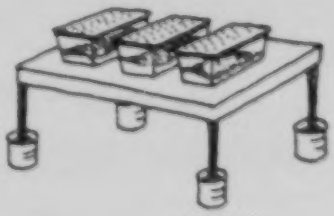
Are you having problems with ants? If the ants get into your terrariums you could do the following to keep them out.

Put the terrariums in water.



OR

Put the legs of the table in cans of water. Add a little bit of kerosene to the water if you want.



Name _____

Date _____

radish

bean

squash

corn

tongan tongan

What kinds of seeds did you plant in your terrarium? How many?

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

What kinds of animals did you put in your terrarium? How many?

_____ _____

_____ _____

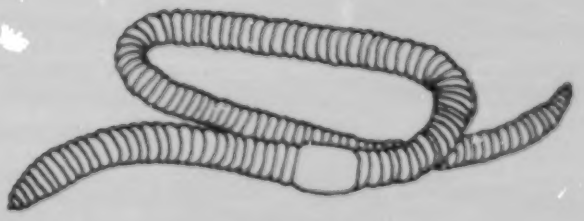
_____ _____

_____ _____

Isopod

Ant

Milliped



Earthworm

Snail

ACTIVITY 2 INVENTING ENVIRONMENTAL FACTORS AND ENVIRONMENT

SYNOPSIS (WHAT WILL YOU BE DOING?)

The students discuss the reasons for the population changes in their terrariums. The things that affected the organisms are listed. These are called ENVIRONMENTAL FACTORS. Everything together that affects the organisms is called the ENVIRONMENT. Other examples of environmental factors and the environment are discussed. The groups plant the plants from their terrariums outside. They observe changes and give their ideas of environmental factors causing the changes.

OVERVIEW OF THIS ACTIVITY (WHY ARE YOU DOING THIS?)

You introduce or "invent" the terms environmental factor and environment for the students. This is just an introduction of these terms and they will be used in the rest of the activities in this unit. Do not expect the students to understand them completely now. They will gain understanding of environmental factor and environment by using the terms along with their experiences in later activities.

The planting of the terrarium plants outside gives the students a chance to grow and observe plants they have started. Some good questions and ideas may come from their observations.

MATERIALS

For each student:
"Changes" worksheet

For the class:
"Populations In The Terrariums" chart from Activity 1

TEACHING SUGGESTIONS

First Day-"Environmental Factors" and "Environment"

1. Look at the "Populations In The Terrariums" chart.

   Have a class discussion: "Why did the populations change?"

   "Why didn't the organisms in all terrariums grow the same?"

   "What affected the organisms in your terrariums?"

As the students give their ideas, list them on the chalkboard. List all the ideas the students give about what affected the organisms in their terrariums.

1. snails eat the plants
2. soil is not good
3. light
4. mold
5.
6.

2. After the students ideas are listed, tell the class:

   "These things that affect organisms are called ENVIRONMENTAL FACTORS".

   Write ENVIRONMENTAL FACTORS on the board.

3. Ask: "What are some ENVIRONMENTAL FACTORS that affect us?"

   List the environmental factors that the students say affect them.

   For example:
   1. The food we eat
   2. Sickness
   3. Our house
   4. Dry season - no rain

4. Point to the lists of environmental factors and tell the class:

   "All of these environmental factors together make up the ENVIRONMENT."

   Point to the list of environmental factors for the terrariums. Say:

   "These factors make up the ENVIRONMENT of the organisms in your terrariums."

   Point to the list of environmental factors for the students. Say:

   "These factors make up your ENVIRONMENT."

5. Write on the board, ENVIRONMENT OF A FISH.

   Ask the students to name all the environmental factors that make up the environment of a fish. (What affects the fish?)

   For example:
   1. Saltwater
   2. Sharks
   3. Smaller fish to eat

   Discuss how the student's environment is different from the environment of the fish.

Second Day-Changing The Environments Of The Terrariums

1. Ask the class: "What do you predict will happen to the plants in your terrariums if you leave them in there?"

   "What do you predict will happen to the plants in your terrariums if you plant them outside?"

   "What is the difference between the environment in your terrariums and the environment outside?"

   Say: "Each group can select a place outside to plant the plants from its terrarium."

2. Let each group release the animals from its terrarium.

   Let each group go outside and plant the plants from their terrariums.

3. Each group should wash and dry its terrarium.

   Put the terrariums away for later use.

Third Day And Later Weeks-Observing The Plants In Their New Environment

1. Give each student a "Change" worksheet.

   Explain the worksheet to the class.

2. Let each group go outside and record their observations for the First Week part of the worksheet.

3. Once a week let the students observe their plants and record on their worksheet.

   Discuss the worksheet after each observation. Some of the environmental factors that affect the plants might be:

   amount of rain
   other students
   plant eaters, insect pests
   amount of sunlight
   wind

   Stop observing when the students lose interest or the plants die.

NAME_____

FIRST WEEK

Make a map of the plants your group planted. The map should show where each plant is and what kind it is.

Map Of My Group's Plants

SECOND WEEK

Look at your plants.
List the changes you observe.

_____
_____
_____
_____

Think of the environmental factors.
Which ones may have caused the change?

_____
_____
_____
_____

THIRD WEEK

Look at your plants.
List the changes you observe.

_____
_____
_____
_____

Think of the environmental factors.
Which ones may have caused the change?

_____
_____
_____
_____

PART 2

LIGHT AS AN ENVIRONMENTAL FACTOR

OBJECTIVES (WHERE PART TWO IS GOING)

At the end of Part Two the students should be able to:

- Describe how some organisms in their environment respond to light.
- Find by experiment how organisms respond to different intensities of light.
- Find by experiment the intensity of light in which some organisms live best.

ACTIVITY 3 LIGHT, ORGANISMS AND THE ENVIRONMENT

SYNOPSIS (WHAT WILL YOU BE DOING?)

The class takes a field trip to observe how different organisms respond to the light in their environment. They discuss what they find and select activities from Part 2 to do in later science lessons.

OVERVIEW OF THIS ACTIVITY (WHY ARE YOU DOING THIS?)

By taking the field trip the students are able to focus on one environmental factor (light) and how the organisms respond to it. This activity allows direct contact with the environment. The students should get ideas and be interested in trying further experiments with light.

This activity is a lead-in for the other activities in Part 2. If you and the students become interested in the response of organisms to light, the activities you choose to do in Part 2 should be interesting. You as a teacher should look at this field trip as a very important activity. If it goes well, the rest of Part 2 should go well.

MATERIALS

For each student:
"Observing Light As An Environmental Factor" worksheet

TEACHING SUGGESTIONS

<u>First Day-Going Outside To Observe Light As An Environmental Factor</u>

1. Have a class discussion:

"How does the environmental factor of light affect you?"

"How do you respond to light?"

"Is light ever too bright for you? What do you do?"

"How do you respond to no light (darkness)? Do you live the same in the dark as in the light?"

"How does light affect other organisms? How do organisms respond to light?"

2. Tell the class that today they will go outside to observe how animals and plants are responding to the light in their environment.

   Give each student an "Observing Light As An Environmental Factor" worksheet. Explain the worksheet to the class.

   Be sure the students understand: They are only looking at the organisms and should not collect or harm any organism. They should replace anything they move like rocks or wood.

3. Take the class outside to the place where they can observe.

   Let the students observe and fill in their worksheets.

Second Day-Discussion And Selecting The Next Activity

1. Have a class discussion:

   "What organisms did you find in bright light? Medium light? Dim light? The dark?"

   "Did you always find the same organisms in the dark?"

   "How do plants respond to light?"

2. Tell the class that they can explore different organism's response to light. Explain the activities to the class. You and the students decide which activity you want to do next.

   Choice #1 - ACTIVITY 4 THE RESPONSE OF SOME ANIMALS TO LIGHT
   In this activity a box is made with bright, medium, dim and dark areas in it. The students put millipedes, flour beetles, flour beetle larvae, or isopods in the box and see which area they go to.

   Choice #2 - ACTIVITY 5 PLANT RESPONSES TO LIGHT
   In this activity the students grow plants in three intensities of light. Some plants are in light. Some plants are in dim light under a box. Some plants are in the dark under a box. The growth of the plants is measured and put on graphs.

   Choice #3 - ACTIVITY 6 WHERE DO PEOPLE PLANT PLANTS?
   The students observe plants planted around the home. They talk with people to see where they plant plants. The students list on charts different plants and the light intensities they are planted in.

NOTE ABOUT THE ACTIVITIES IN PART TWO

The students may do some or all of the activities in Part 2. You and the students choose the activities that are of interest and for which you have materials.

After doing several of the activities in Part 2, the students may get their own ideas about other experiments. Let them set up other experiments about light as an environmental factor if they want to. Experiments they make up themselves will be just as good as using the ones in the book.

Name _____

Find an organism to observe. Write down its name or draw a picture of it.

Mark the amount of light you observe in its environment.

Do not harm the organisms. Put all organisms rocks or wood back like you found it.

Observe as many organisms as you can.

ORGANISM	LIGHT IN THE ORGANISM'S ENVIRONMENT			
	BRIGHT (direct sun)	MEDIUM (shaded)	DIM (little light)	DARK (no light)
_____				
_____				
_____				
_____				
_____				
_____				
_____				
_____				

ACTIVITY 4 THE RESPONSE OF SOME ANIMALS TO LIGHT

SYNOPSIS (WHAT WILL YOU BE DOING?)

The students collect millipedes, isopods, flour beetles or flour beetle larvae and put them in a box that has light at one end. They leave the animals in the box overnight. The next day, they look in the box and record where the animals are. They look at their records to see what light intensity most of the animals were at.

OVERVIEW OF THIS ACTIVITY (WHY ARE YOU DOING THIS?)

In this activity students can do classroom experiments concerning light intensities. By giving organisms different choices of light intensities the students can observe which intensities they move to. They can see that organisms do respond to light.

MATERIALS

For each student:
- "Animals' Response To Light" worksheet

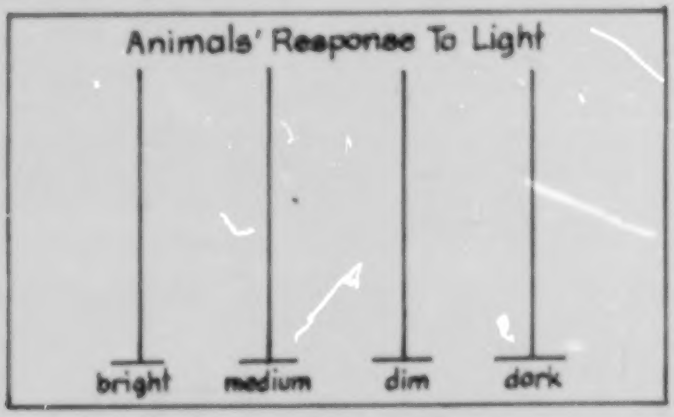
For each group of four students:
- piece of aluminum foil - 6 inches X 18 inches
- sheet of black paper - 3 inches X 18 inches
- small piece of clear cellophane or plastic to make the window

For the class:
- scissors
- markers
- chart paper
- masking tape

NOTE: You and the students decide which animals to use. Millipedes and isopods can be found under rocks or pieces of wood. Flour beetles or larvae can be found in flour or things made of flour.

ADVANCE PREPARATION

Make a Animals' Response To Light chart like this one.



TEACHING SUGGESTIONS

First Day-Building A Light Experiment Box

1. Give each student an "Animals' Response To Light" worksheet. Look at the side that shows how to build a light experiment box.

   Carefully explain how to build the light experiment box while the students look at the worksheet.

2. Divide the class into groups of four students each. Give each group the materials to build one light experiment box.

   Help the groups follow the directions on the worksheet and build the box.

3. After the students are finished building the boxes, have a class discussion:

   "How can we use the box to see how animals respond to light?"

4. Tell the students that some of the animals they could use are:

   millipedes
   isopods
   flour beetles
   flour beetle larvae

   Discuss which ones they will use in the experiment. They will need the animals tomorrow. They would have to bring flour beetles or flour beetle larvae from home. They will go outside tomorrow to get isopods and millipedes.

   You and the students decide which animal you will use. You may decide to use several different ones. If you are using more than one animal, experiment with one and then experiment with the next one. It is best not to mix them together.

Second Day-Finding Millipedes And Putting Them In The Boxes

1. Tell the students that each group should find six of the animals for their light experiment box.

   They can put the animals in the box today and observe them tomorrow.

2. Let each group go outside and collect six animals for their box.

The light experiment boxes should be placed somewhere in the room where plenty of light will shine through the windows on the boxes.

Caution the students not to open the boxes until science class tomorrow.

Third Day-Observing The Millipedes

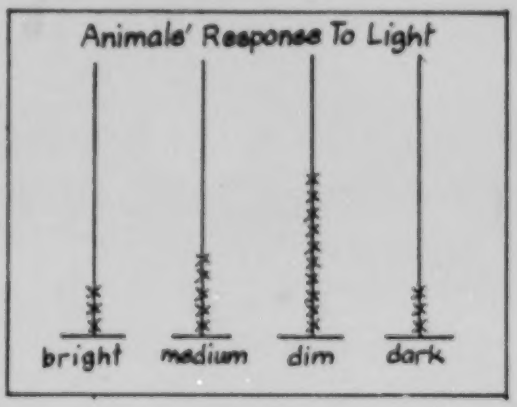
1. Each student should look at his "Animals' Response To Light" worksheet.

   Each group will carefully open their box and record on the worksheet the position of all six animals.

2. Mix the animals up and see where they go again. The box should set for five minutes before opening it to observe again.

3. Put the boxes away.
   Put up the Animals' Response To Light chart.

   Let each group put Xs on the chart to show where each of the animals were in their box. They should only use their first observation. Each group will put six Xs on the chart.



4. Have a class discussion:

   "Did the animals stay at any special place in the box?"

   "Which light intensities were most of them found at?"

   "Were they found in any other light intensity?"

   "What happened when you did the experiment again?"

   "Did you find any animals during the field trip for Activity 3? What light intensity did you find them in?"

5. Put the animals outside.
   Put the light experiment boxes away.

OPTIONAL ACTIVITY

You may find other animals to use with the light intensity box. For example earthworms.

Name_____

Take the lid off the box

Make Xs on the diagram to show where each animal is.

BRIGHT	MEDIUM	DIM	DARK

Do the experiment again. Put the animals back in the box.

Make dots on the diagram to show where each animal started.

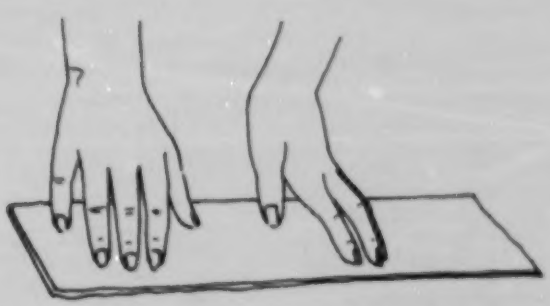
Let the box set with the lid on for five minutes.

Take the lid off the box.

Make Xs on the diagram to show where each animal is.

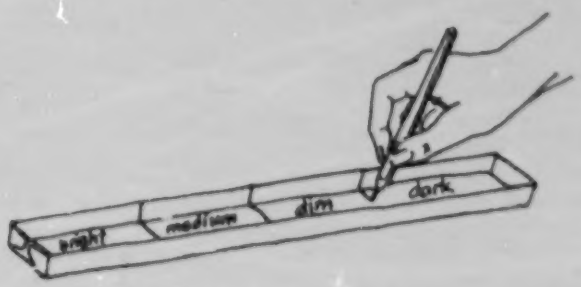
BRIGHT	MEDIUM	DIM	DARK

Directions for making a light experiment box.



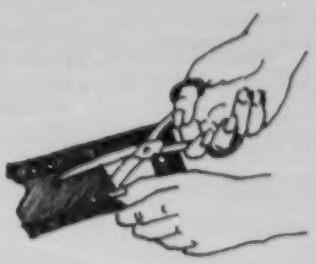
#1 Fold the aluminum foil lengthwise.

#2 Fold the edges up. Tape the ends.

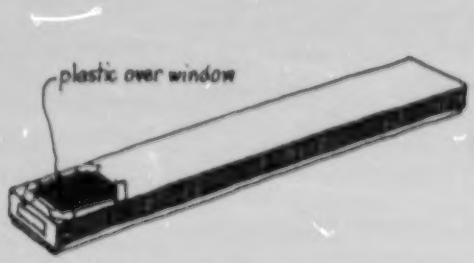


#3 Mark the box into four equal parts. Label the parts: bright, medium, dim and dark.

#4 Fold the edges of the black paper up. Make a top for the box. Tape the ends.



#5 Make a hole in one end of the top. This is a window to let in light.



#6 Put cellophane or clear plastic over the window. Tape the cellophane or plastic on. Place the lid on the aluminum foil box.

ACTIVITY 5 PLANT RESPONSES TO LIGHT

SYNOPSIS (WHAT WILL YOU BE DOING?)

The class grows plants under three environmental conditions: some plants are in the light, some plants are under a box that has a small hole in it, and some plants are under a box with no light.

OVERVIEW OF THIS ACTIVITY (WHY ARE YOU DOING THIS?)

Students may predict that light is good for plants, but never thought about how much light and what kinds of plants. This activity lets the students see how one kind of plant responds to three different intensities of light. They can predict the environment this plant would grow best in.

MATERIALS

For each student:

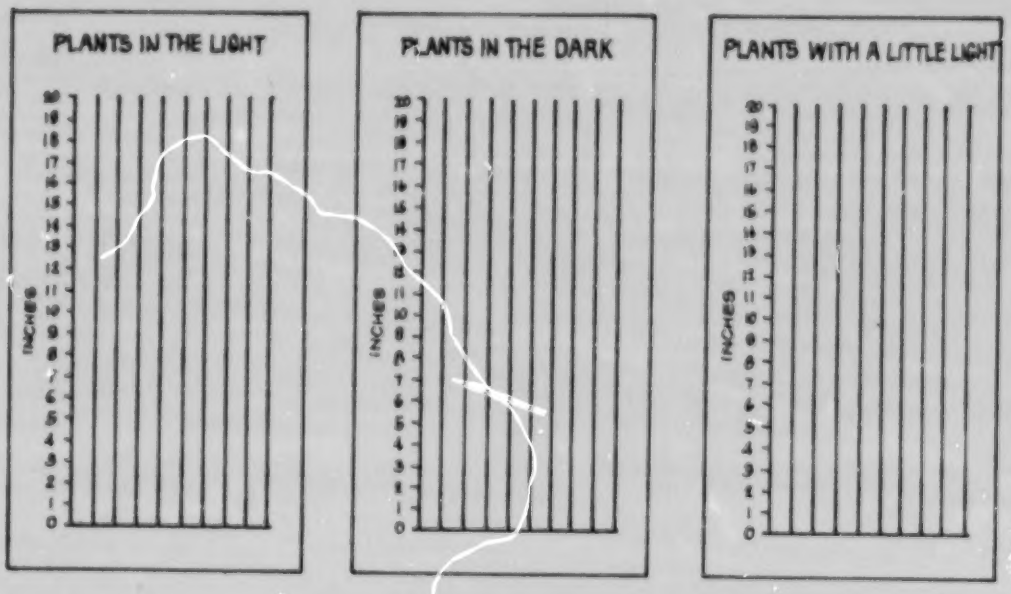
- two bean seeds or any local substitute that germinates quickly
- can for planting the seed in
- crayon
- strip of paper 1 inch X 10 inches

For the class:

- two cardboard boxes
- soil - must be the same for all students
- cans for water
- three pieces of chart paper
- masking tape

ADVANCE PREPARATION

Make three charts. Mark off the left side in inches. Put ten lines on each chart.



TEACHING SUGGESTIONS

First Day-Setting Up The Experiment

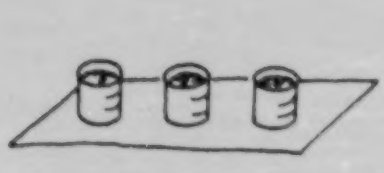
1. Have a class discussion:

   "Do plants grow differently in different amounts of light?"

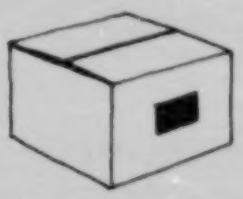
2. Explain to the class that they can do an experiment to see how plants respond to different amounts of light.

   They will each plant seeds and observe how they grow.

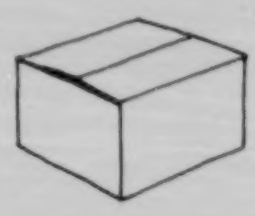
   The cans of seeds will be in three different places:



some in the light



some under a box with a small hole in it



some under a box with no light

3. Discuss how to keep all other things the same in the experiment:

   "How can we be sure all plants get the same amount of water?"

   "How can we be sure all plants are in the same kind of soil?"

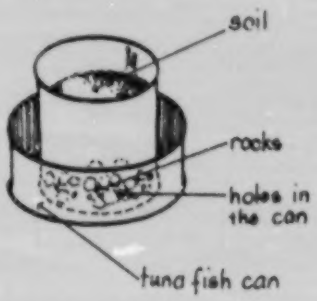
   "Why is it important to have the same soil and water?"

4. Divide the class into groups of three students each.

   Each group will get three cans.

   Give each group six seeds. Two for each can.

   Let each group plant their seeds.



5. The students in each group should put their names on their cans.

Each group should put one can under the box, one can under the box with a hole, and one can in the light.

Second Day-Setting Up A Watering Schedule

1. Let the students decide on a watering schedule for the plants.

   Every Monday, Wednesday and Friday is a good schedule because they will be observing the plants on those days.

The Days After The Seeds Come Up

1. Put the three charts up.

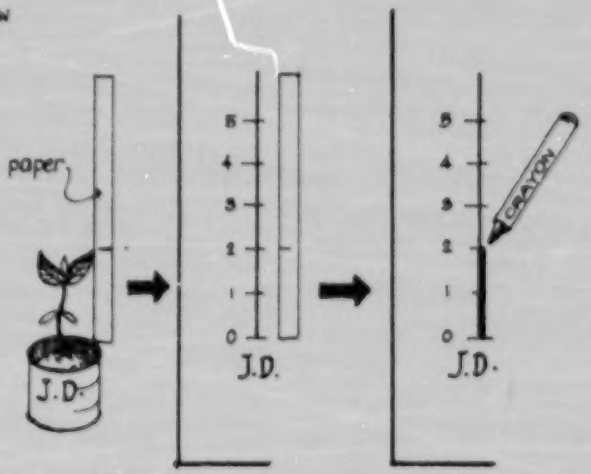
2. Let the students observe their plants every Monday, Wednesday and Friday.

   After each observation they should record the growth on the chart. They record the growth by doing these things:

   1st. - Hold a strip of paper up to the plant and mark how high it is.

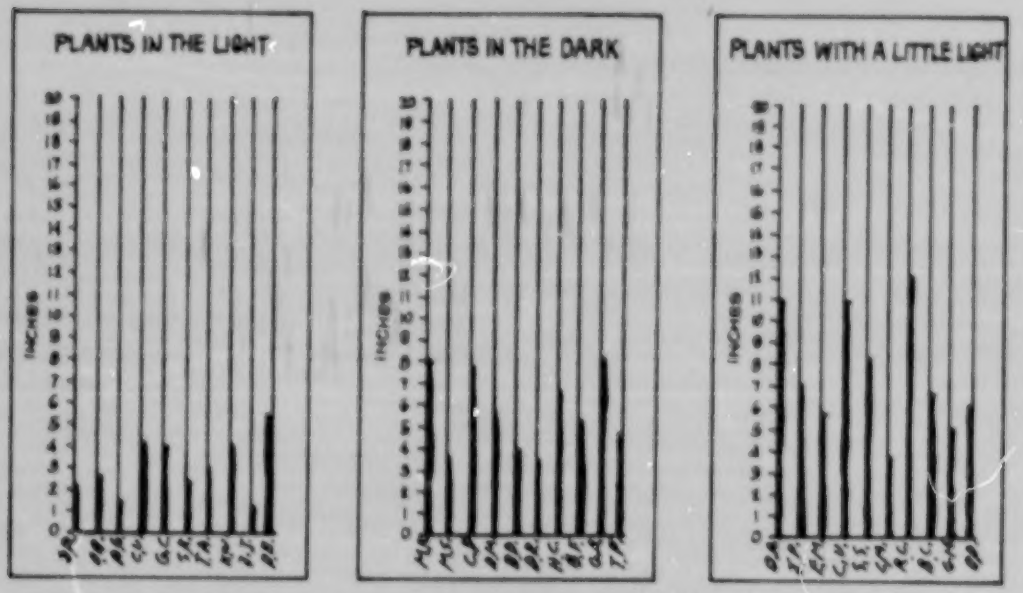
   2nd. - Take the strip of paper to the correct chart. Mark the height from the paper onto a line on the chart.

   3rd. - Put your name on the line. Use a crayon to mark the line from the bottom to the mark showing how high your plant is. The crayon mark should now be the same height as your plant.



Each time the students observe they should measure their plants with the strip of paper and mark their line on the chart.

Example of charts:



Observe the plants for two weeks.

AFTER TWO WEEKS DO THE FOLLOWING LESSONS

Discuss the Charts And Observations

1. Take the boxes off the plants. Put the charts where everybody can see them.

2. Have a class discussion:

   "How do the plants compare in height?"

   "How do the plants compare in color?"

   "How do the plants compare in looking healthy?"

   "Did the plants grow at the same rate?"

   "Did the plants respond to the light by growing in any particular direction?"

   "How do you predict these same seeds would grow if you planted them outside under a large tree?"

   "How do you predict these same seeds would grow if you planted them outside in an open place?"

3. Decide what to do with the plants. Here are some suggestions:

Keep observing them for two more weeks. Keep the charts. Have another class discussion after the two weeks.

Plant the plants outside. Observe how they change.

Let the students take the plants home.

Throw the plants away and clean up the materials.

ACTIVITY 6 WHERE DO PEOPLE PLANT PLANTS?

SYNOPSIS (WHAT WILL YOU BE DOING?)

Where do people plant plants? Which ones do they put in bright light? Which ones do they put in shade? The students observe around their home and talk to people to find answers to these questions. The class then makes a list of plants and what intensities of light they are planted in.

OVERVIEW OF THIS ACTIVITY (WHY ARE YOU DOING THIS?)

In this activity the students are encouraged to relate where local people plant things with the intensities of light at these places. It is hoped that the students can see how man plants a certain kind of plant in an environment that has the best light intensity for that plant.

MATERIALS

For each student:
"Where Do People Plant Plants" worksheet

For the class:
chart paper

TEACHING SUGGESTIONS

<u>First Day-Where Do People Plant Plants?</u>

1. Discuss: "What kinds of plants do people plant?"

   "Why do people plant plants?"

   "What plants do people plant in bright sunlight (no shade)?"

   "What plants do people plant in some shade?"

   "What plants do people plant where it is always in the shade?"

2. Give each student a "Where Do People Plant Plants" worksheet. Explain the worksheet to the class.

Discuss: "Where can you observe plants to put on the worksheet?"

"Who can talk to you about where they plant plants?"

3. Let the students take the worksheets home to fill them out.

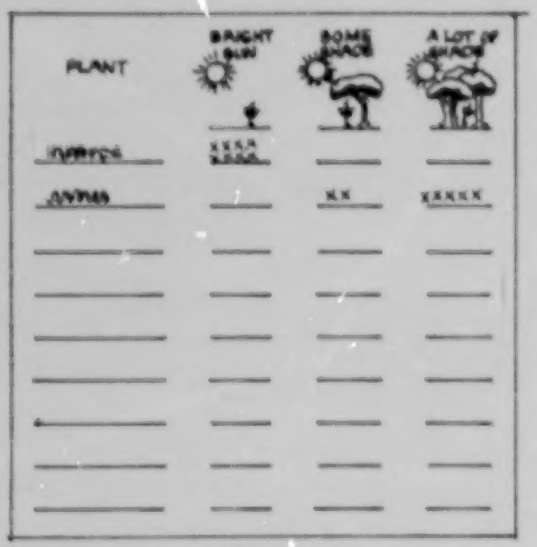
Second Day-Making The Chart

1. Put the chart paper up.

   Let the students report from their worksheets about where people plant plants.

   List the plant names on the chart.

   Put an X for the place each student says the plant will be planted. (bright sun, some shade, a lot of shade)



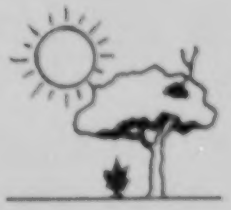
2. Discuss the chart after it is finished:

   "Which plants are usually in the bright sun? Why do you think people put them in this kind of an environment?"

   "Which plants are usually in a little shade? Why do you think people put them in this kind of an environment?"

   "Which plants are usually in a lot of shade? Why do you think people put them in this kind of environment?"

Name _____

NAME OF PLANT	PLANTED IN THE BRIGHT SUN	PLANTED IN SOME SHADE	PLANTED IN A LOT OF SHADE
			
_____	____	____	____
_____	____	____	____
_____	____	____	____
_____	____	____	____
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_____	____	____	____
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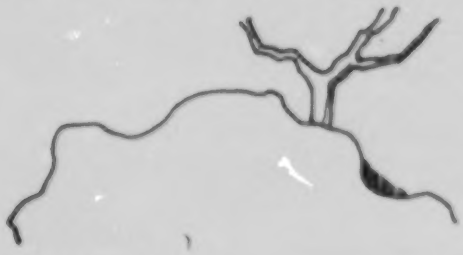
PART 3 TEMPERATURE AS AN ENVIRONMENTAL FACTOR



OBJECTIVES (WHERE PART THREE IS GOING)

At the end of Part Three the children should be able to:

- Describe the range and optimum range of the environmental factor temperature in experiments they do or observations they make outside.

ACTIVITY 7 TEMPERATURE, ORGANISMS AND THE ENVIRONMENT

SYNOPSIS (WHAT WILL YOU BE DOING?)

The class takes a field trip to observe how different organisms respond to different temperatures in their environment. They discuss what they find and select activities from Part 3 to do in later science lessons.

OVERVIEW OF THIS ACTIVITY (WHY ARE YOU DOING THIS?)

By taking the field trip the students are able to focus on one environmental factor (temperature) and how organisms respond to it. This activity allows direct contact with the environment. The students should get ideas and be interested in trying further experiments with temperature.

This activity is a lead-in for the other activities in Part 3. If you and the students become interested in the response of organisms to temperature, the activities you choose to do in Part 3 should be interesting. You, as the teacher should look at this field trip as a very important activity. If it goes well, the rest of Part 3 should go well.

MATERIALS

For each student:
- "Observing Temperature As An Environmental Factor" worksheet

For every group of two students:
- thermometer

TEACHING SUGGESTIONS

First Day-Going Outside To Observe Temperature As An Environmental Factor

1. Have a class discussion:

   "How does the environmental factor of temperature affect you?"

   "How do you respond to temperature?"

   "Is it ever too warm for you? What do you do?"

   "Is it ever too cool for you? What do you do?"

   "How does temperature affect other organisms? How do organisms respond to temperature?"

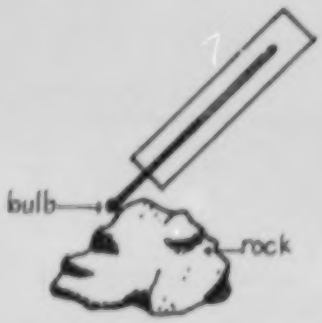
2. Tell the class that today they will go outside to observe how animals and plants are responding to the temperature of their environment.

   Give each student an "Observing Temperature As An Environmental Factor" worksheet. Explain the worksheet to the class.

3. Divide the class into groups of two students each. Give each group a thermometer.

   Review how to use and read the thermometer.

   Caution the class on using the thermometers carefully. They should carefully touch the bulb of the thermometer against the rock or soil to take the temperature.



4. Be sure the students understand: They are only looking at the organisms and should not collect or harm any organism. They should replace anything they move like rocks or wood.

5. Take the class outside to the place where they can observe.

   Let the students observe and fill in their worksheets.

Second Day-Discussing And Selecting The Next Activity

1. Have a class discussion:

   "What was the highest temperature you found organisms in?"

   "What was the lowest temperature you found organisms in?"

   "What was the temperature you found most of the organisms in?"

   "Did you always find the same organisms in the same temperature?"

   "How do you think an organism would respond if the temperature they are in changed?"

2. Tell the class they can explore different organism's response to temperature. Explain the activities to the class. You and the students decide which activity you want to do next.

Choice #1 - ACTIVITY 8 THE RESPONSE OF SNAILS TO TEMPERATURE
In this activity snails are put by rocks of different temperatures. The students observe the temperature of each rock and what the snail does. The snail may climb or not climb the rock. The results of the experiments are put on a chart.

Choice #2 - ACTIVITY 9 RANGE AND OPTIMUM RANGE
The class goes outside to find the lowest and highest temperatures in the environment. This is the RANGE of temperature. Then the class selects one kind of animal to find what temperature it is living in. The temperatures this kind of animal is found in most of the time is called the OPTIMUM RANGE.

NOTE ABOUT THE ACTIVITIES IN PART THREE

The students may do some or all of the activities in Part 3. You and the students choose the activities that are of interest and for which you have the materials.

After doing some of the activities in Part 3, the students may get their own ideas about other experiments. Let them set up other experiments about temperature as an environmental factor if they want to. Experiments they make up themselves will be just as good as using the ones in the book.

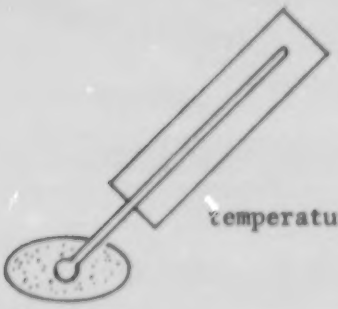
Name_____

Find an organism to observe. Write down its name or draw a picture of it.

Use your thermometer to take the temperature of its environment. Record the temperature.

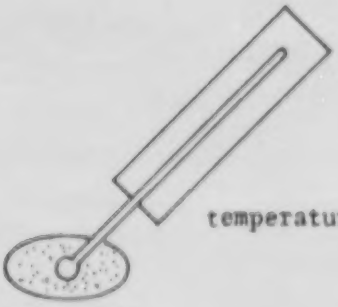
Do not harm the organisms. Put all organisms, rocks and wood back like you found it.

Observe as many organisms as you can.



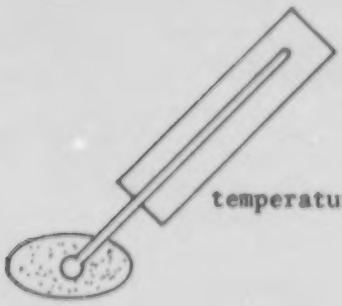
temperature_____

organism _____



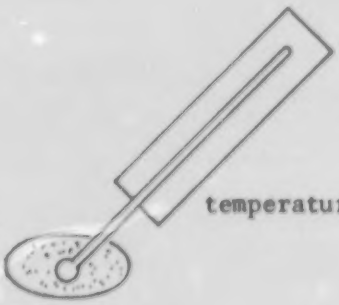
temperature_____

organism_____



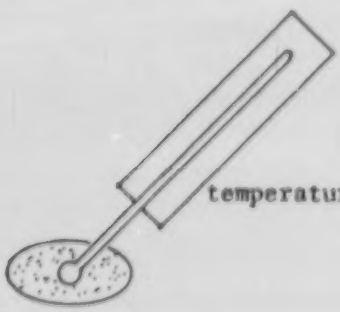
temperature_____

organism _____



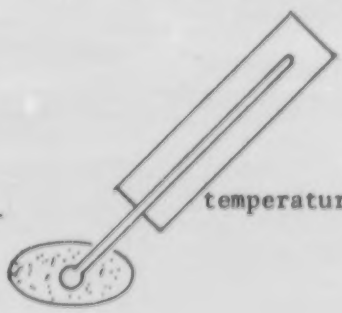
temperature_____

organism_____



temperature_____

organism_____



temperature_____

organism_____

ACTIVITY 8 SNAILS' RESPONSE TO TEMPERATURE

SYNOPSIS (WHAT WILL YOU BE DOING?)

Each group puts snails near hot, room temperature and cool rocks. They record the snails' response on a worksheet.

OVERVIEW OF THIS ACTIVITY (WHY ARE YOU DOING THIS?)

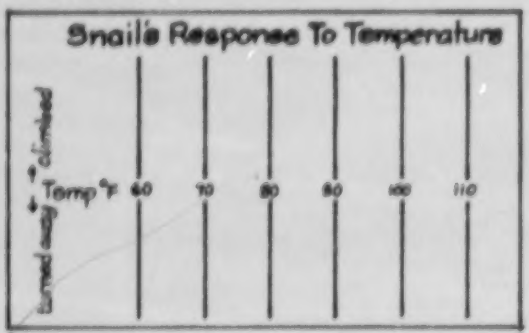
Here the students can relate the temperatures they found the snails in with the temperatures the snails react to in the experiment.

MATERIALS

For each student:
- "Snails' Response To Temperature" worksheet

For each group of two students:
- thermometer
- container to hold the snails

For the class:
- chart paper
- masking tape



ADVANCE PREPARATION

Make a SNAILS' RESPONSE TO TEMPERATURE chart.

TEACHING SUGGESTIONS

<u>First Day-Setting Up The Experiment</u>

1. Tell the class that tomorrow they can experiment to see how snails respond to rocks of different temperatures.

   Today they should get the rocks ready. Each group will need one hot rock, one room temperature rock and one cool rock.

   Discuss how to make the rocks hot for tomorrow. For example: set them on a piece of metal in the sun, heat them with a fire, put them by a light bulb or lantern.

Discuss how to make the rocks cool for tomorrow. For example: pour water over them and let them dry, put them in the ground, put them in a refrigerator or on ice.

The room temperature rocks can be kept in the room until needed.

2. Divide the class into groups of two students each. Let each group plan how to get their hot, room temperature and cool rocks for tomorrow. Two rocks of each kind should be enough.

3. Give each group a "Snails' Response To Temperature" worksheet. Give each group a thermometer.

   Explain how to do part A of the worksheet.

   Caution the students to be very careful when touching the thermometer to anything. Touch the thermometer stem to the rock or soil very easily.

4. Let each group go out and find three to six snails. They should fill in part A of the worksheet as they collect the snails.

   Each group should keep its snails in a container until tomorrow.

Second Day-Doing The Experiment

1. Go over part B of the worksheet with the class.

2. Let each group get their rocks, snails, and thermometer. Let them do the experiment.

3. Put up the SNAILS' RESPONSE TO TEMPERATURE CHART.

   Let each group put Xs on the chart to show how its snails responded. There should be an X for each time the snail was placed in front of a rock.

4. Have a class discussion:

   "Are there any temperatures at which most of the snails climbed rocks?"

   "Are there any temperatures at which only a few snails climbed rocks?"

   "How did the temperatures of the rocks the snails climbed compare with the temperature of the places where you found the snails?"

   "How do you predict snails would respond if their environment gets hot?"

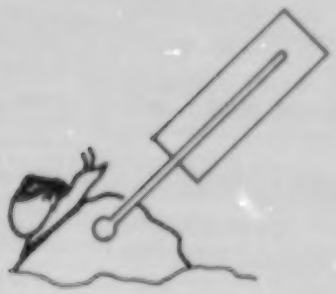
   "How do you respond when your environment gets hot? Cold?"

Name_____

PART A

You and your partner find three snails.

Record the temperature of the environment where you find each snail.

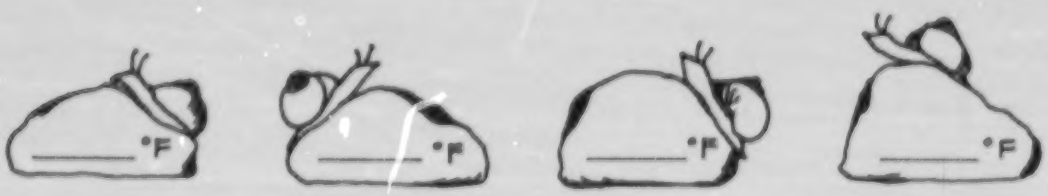


temperature_____ temperature _____ temperature_____

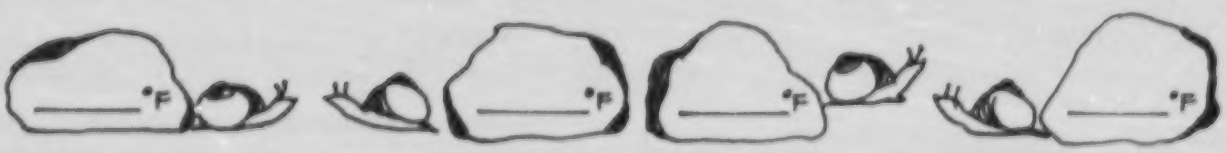
PART B

Put a snail by a hot rock.
Put a snail by a room temperature rock.
Put a snail by a cool rock.

Observe the snails. Record the temperatures of rocks the snails climbed.



Record the temperatures of rocks the snails turned away from.



ACTIVITY 9 RANGE AND OPTIMUM RANGE

SYNOPSIS (WHAT WILL YOU BE DOING?)

The class selects an organism to work with. The students go outside to find the range of temperature-the highest and lowest temperatures they can find. Then the students go outside and find the temperature of the environment they find one kind of animal in. These temperatures are recorded and the optimum range for that organism is decided.

OVERVIEW OF THIS ACTIVITY (WHY ARE YOU DOING THIS?)

The terms RANGE and OPTIMUM RANGE make discussions of environmental factors easier. This activity introduces (invents) these two terms. Talking about all the temperatures from the highest to the lowest is the same as the range. Talking about the temperatures that seem to be best for an organism is the optimum range. The students can have the range and optimum range concepts without the terms, but the terms make it easier to talk about.

This activity allows the students to directly observe how animals in their local environment are responding to temperature. They can observe the range of temperature and how certain animals seem to be found in certain temperatures (optimum range) within that range.

MATERIALS

For each student:
"Temperature-Optimum Range" worksheet

For each group of two students:
thermometer

For the class:
chart paper

TEACHING SUGGESTIONS

<u>First Day-Finding The Range Of Temperatures</u>

1. Have a class discussion:

   "Where do you think the highest temperature is outside? This is natural temperature and not because of a fire."

   "Where do you think the coolest temperature is outside?"

2. Divide the class into groups of two students each.

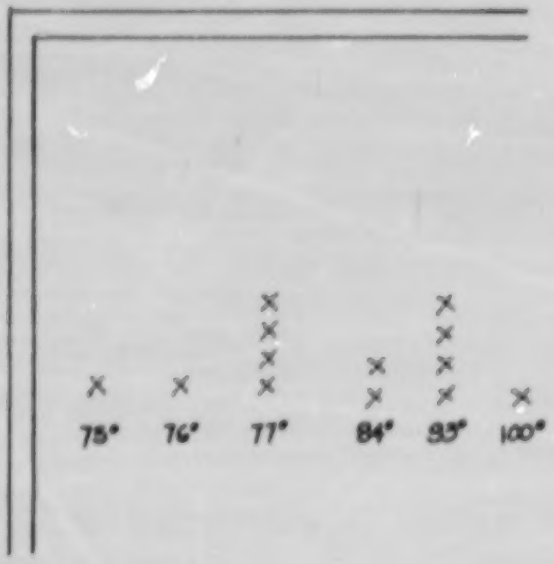
   Give each group a thermometer and a sheet of paper.

3. Each group should go outside and find the place with the highest and the lowest temperature. They should write down the temperature of the place.

4. Let the students return to the classroom to report their temperatures.

   Ask each student to report the highest and lowest temperatures they found.

   Record the temperatures on the chalkboard like in the picture to the right.



5. Draw a line from the lowest to the highest temperature.

   Tell the class that this is the RANGE of the temperatures in the environment. The RANGE is from the highest to the lowest temperature.

   Write RANGE on the chalkboard.

6. Have a class discussion:

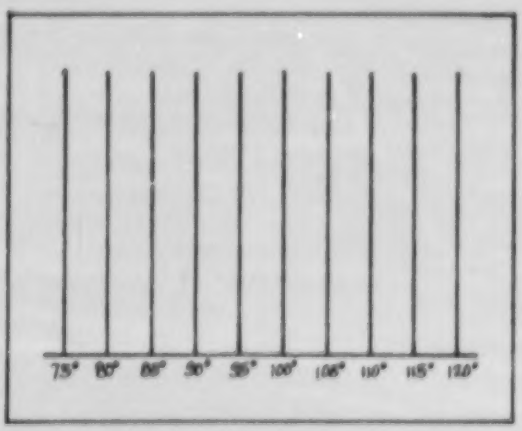
   "What is the range of temperatures in the environment of any organism outside?"

   "Do you think some animals will be found at all of the temperatures inside the range?"

   "Do you think certain animals would choose to be at certain temperatures within the range?"

7. Put the chart paper on the wall.

   Mark the range of temperatures on the bottom. Mark them into equal divisions.



Second Day-The Optimum Temperature Range For An Animal

1. Tell the class that today they will go outside to find the temperature of the environment of one kind of animal.

   Let the class decide on the one kind of animal they will work with. For example: millipede, grasshopper, earthworm, isopod, mosquito larvae, lizard and ant.

2. Give each student a "Temperature-Optimum Range" worksheet. Explain the worksheet to the class.

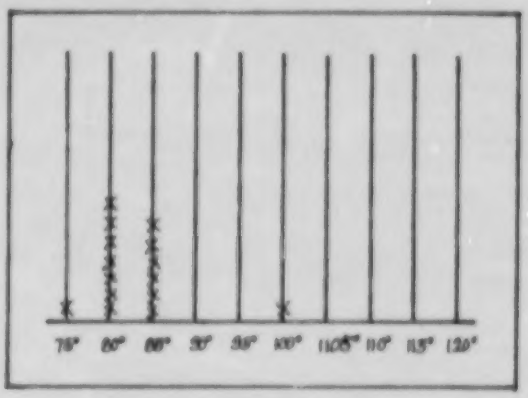
3. Give each group a thermometer.

   Let the groups go outside and fill in their worksheet.

4. After about fifteen minutes let the students come back into the classroom to report what they found.

   Let the students report the temperatures of the animal's environment.

   Record the temperatures on the chart using Xs.



5. Have a class discussion:

   "Were there animals in all temperatures of the range?"

   "What part of the range are most of the animals in?"

   "The part of the range most of the animals live in is called the OPTIMUM RANGE."

   Draw a box around the OPTIMUM RANGE section of the chart.

The OPTIMUM RANGE is that part of the temperature range where the organism lives best.

"Do you think other animals have a different optimum temperature range?"

"What do animals do if the temperature of their environment changes?"

"What do you think your optimum temperature range is?"

"What do you do if the temperature of your environment changes?"

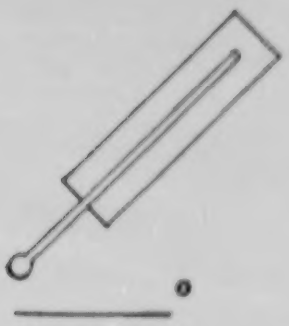
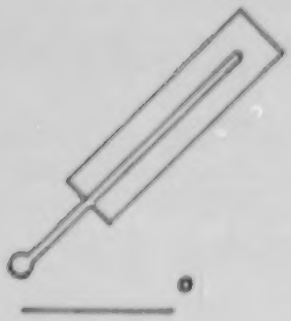
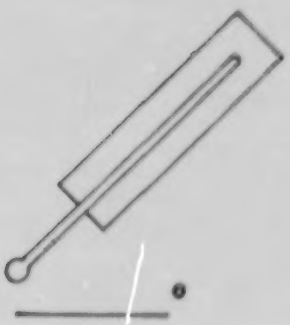
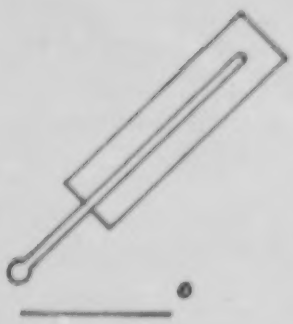
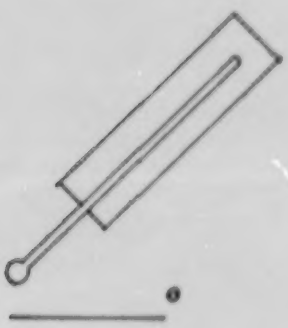
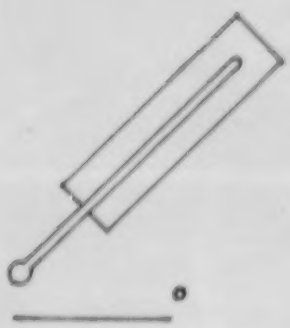
"Do you think daylight animals have the same optimum temperature range as night animals?"

Name _____

The animal the class is looking for is the _____
animal's name

Each time you find this animal, find the temperature of its living place.

Do not harm the organisms. Put all organisms, rocks and wood back like you found it.

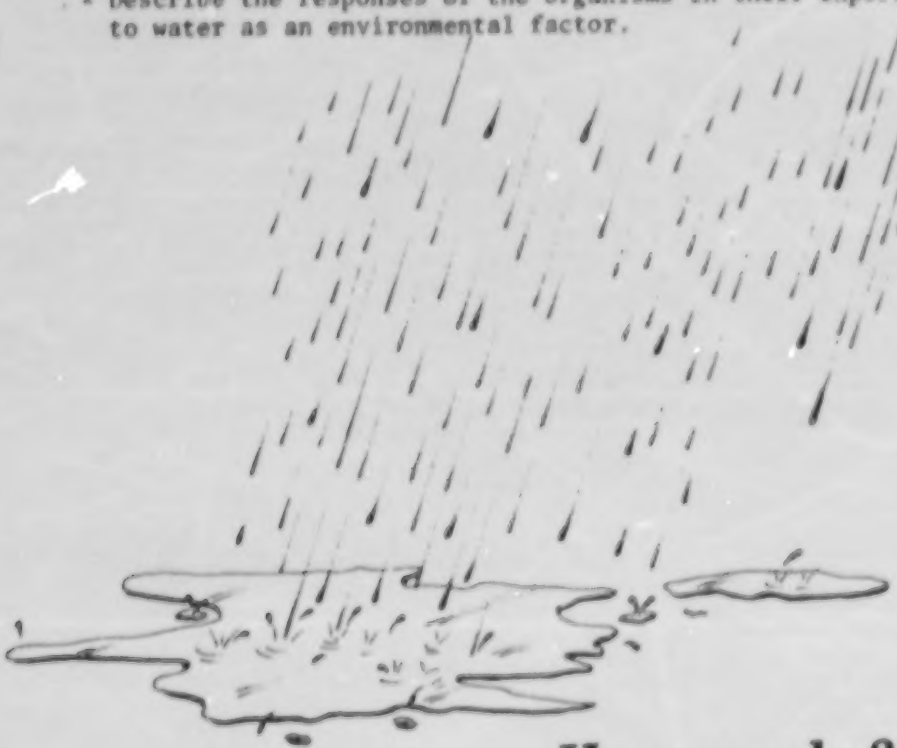
PART 4

WATER AS AN ENVIRONMENTAL FACTOR

OBJECTIVES (WHERE PART FOUR IS GOING)

At the end of Part Four the students should be able to:

- Describe the responses of the organisms in their experiments to water as an environmental factor.



How much ???

ACTIVITY 10 WATER, ORGANISMS AND THE ENVIRONMENT

SYNOPSIS (WHAT WILL YOU BE DOING?)

The class takes a field trip to observe how different organisms respond to the water in their environment. They discuss what they find and select activities from Part 4 to do in later science lessons.

OVERVIEW OF THIS ACTIVTTY (WHY ARE YOU DOING THIS?)

By taking the field trip the students are able to focus on one environmental factor (water) and how the organisms respond to it. This activity allows direct contact with the environment. The students should get ideas and be interested in trying further experiments with water.

This activity is a lead-in for the other activities in Part 4. If you and the students become interested in the response of organisms to water, the activities you choose to do in Part 4 should be interesting.

MATERIALS

For each student:
"Observing Water As An Environmental Factor" worksheet

TEACHING SUGGESTIONS

First Day-Going Outside To Observe Water As An Environmental Factor

1. Have a class discussion:

   "What organisms live in very dry places?"

   "What organisms live in damp places?"

   "What organisms live in wet places?"

   "What organisms live in water?"

2. Tell the class that today they will go outside to observe how organisms are responding to water in their environment.

   Give each student an "Observing Water As An Environmental Factor" worksheet.

3. Take the class outside to the place where they can observe.

   Let the class observe and fill in the worksheet.

Second Day-Discussing And Selecting The Next Activity

1. Have a class discussion:

   "What organisms did you find in very dry places?"

   "What organisms did you find in damp places?"

   "What organisms did you find in wet places?"

   "What organisms did you find living in water?"

   "What would these organisms do if their environment gets drier?"

   "What would these organisms do if their environment gets wetter?"

2. Tell the class that they can explore different organism's response to water. Explain the activities to the class. You and the students decide which activity you want to do next.

   Choice #1 - Seeds are planted in different jars. Each jar gets a different amount of water. The class observes how the seeds respond to different amounts of water.

   Choice #2 - The students put earthworms in terrariums and observe them. They flood the terrariums with water and observe how the earthworms respond.

NOTE ABOUT THE ACTIVITIES IN PART FOUR

The students may do some or all of the activities in Part 4. You and the students choose the activities that are of interest and for which you have materials.

After doing several of the activities in Part 4, the students may get their own ideas about other experiments. Let them set up other experiments about light as an environmental factor if they want to. Experiments they make up themselves will be just as good as using the ones in the book.

Name_____

Find an organism to observe. Write down its name or draw a picture of it.

Mark the amount of water you observe in its environment.

Do not harm the organisms. Put all organisms, rocks or wood back like you found it.

Observe as many organisms as you can.

ORGANISM	WATER IN THE ORGANISM'S ENVIRONMENT			
	IN WATER	WET	DAMP	DRY
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

ACTIVITY 11 PLANT RESPONSES TO WATER

SYNOPSIS (WHAT WILL YOU BE DOING?)

The class uses different amounts of water on seeds. They observe and record which seeds germinate and decide on an optimum range for germination of this kind of seed.

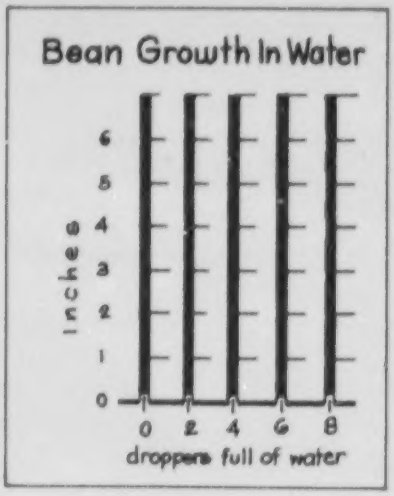
OVERVIEW OF THIS ACTIVITY (WHY ARE YOU DOING THIS?)

The students explore water as an environmental factor. The experiment is very specific and should give the students good experience in carrying out an experiment, recording data, and drawing a conclusion from the data.

MATERIALS

For each group of five students:
- ten bean seeds (any fast germinating seed may be substituted)
- medicine dropper
- five small jars or vials - all the same
- small container of water
- plastic spoon
- ruler

For the class:
- soil
- masking tape
- chart paper



ADVANCE PREPARATION

Make a BEAN GROWTH IN WATER chart like in the picture.

TEACHING SUGGESTIONS

<u>First Day-Planting Some Seeds</u>

1. Have a class discussion:

   "Did you put water in your terrarium in Activity 1? Why?"

   "Do seeds need water to start to grow? How much?"

   "If you put a seed in soil and do not add any water, will it start to grow?"

2. Tell the class that they can do an experiment to find how much water is needed to make bean seeds grow best.

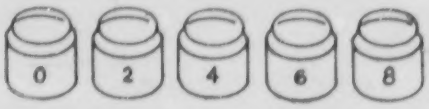
   Each group will set up five jars. Each jar will have soil and two seeds in it.

   Draw this on the chalkboard for the class.

3. Discuss the factors in the experiment that should be the same for each jar: kind of soil, amount of soil, where you put the jars, how deep you plant the seeds.

   Discuss the factor in the experiment that will be different for each jar: amount of water.

4. Show the class a medicine dropper. Explain that this will be used to measure the water for the jars:

   one jar will get 0 droppers full of water
   one jar will get 2 droppers full of water
   one jar will get 4 droppers full of water
   one jar will get 6 droppers full of water
   one jar will get 8 droppers full of water

   Put this on the chalkboard for the class.

5. Divide the class into groups of five students each.

   Let the class decide on the following:

   How many spoons of soil will you put in each jar? They must all be the same.

   How deep will you plant the seeds? They must all be the same.

   Where will you put your jars? They must all be in the same place.

6. Be sure the groups understand that they are to set up one complete set of jars like on the chalkboard. They must be very careful to put in the correct amounts of water.

   Give each group their materials and let them set up the experiment: five jars, ten seeds, medicine dropper, container of water, plastic spoon, soil, and masking tape.

Each jar should be labeled with the students' name and the number of droppers full of water put in the jar.

7. There will be no more water added to the jars during the experiment. Be sure the class understands this.

Second, Third, Fourth, Fifth, Sixth And Seventh Days-Observation During Free Time

During these days there will be no observation of the seeds during science class. The students may observe the jars during their free time if they want to.

No more water should be put in any of the jars.

Eighth Day-Observing, Making A Chart And Discussion

1. Let each group get its jars and observe for plant growth.

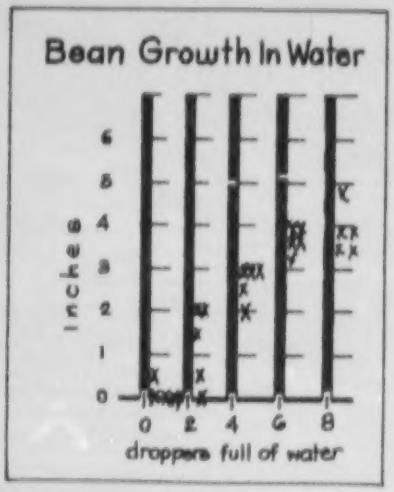
   Each student should measure the plant in his jar. If there are two plants in the jar, measure the tallest one. Some jars will not have any plants.

2. Put up the BEAN GROWTH IN WATER chart.

   Ask all the students with jars of 0 droppers full of water to report their measurements. Put an X on the chart for each student's measurement.

   Ask all the students with jars of 2 droppers full of water to report their measurements. Put an X on the chart for each student's measurement.

   Do the same thing for the students with the 4, 6 and 8 droppers full on their jars. Record the measurement on the chart.



3. Discuss the chart:

   "In which amounts of water did the seeds grow best?"

   This is called the OPTIMUM RANGE. Out of all the amounts of water this amount is the best for the seeds.

"Is water important for seeds to start growing (germinate)?"

"What does this kind of seed's response to water tell us?"

"Do you think other kinds of seeds would have the same optimum range of water?"

"Where would be the best environment outside to plant these plants after we are finished with them?"

"How could you make the seeds grow that did not start to grow in the jars?"

Ninth Day-Cleaning Up The Experiment

1. Let the class decide what to do with the plants. They could:

   Think of a new experiment to use them in.

   Plant them outside in the best environment they can find.

   Take them home.

   Throw them away.

2. Clean up the jars after the plants are out of them.

ACTIVITY 12 FLOODED EARTHWORMS

SYNOPSIS (WHAT WILL YOU BE DOING?)

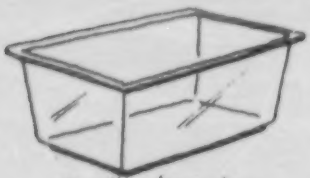
The students observe earthworms in a jar. Then they flood the soil in the jar with water and observe the response of the earthworms.

OVERVIEW OF THIS ACTIVITY (WHY ARE YOU DOING THIS?)

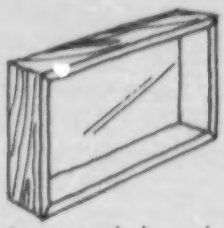
The students gain experience observing a very beneficial organisms, the earthworm. The earthworm cultivates the soil by mixing it and letting air into it. They can observe how the earthworm responds to the soil being flooded. This is a very real situation because earthworms do get flooded out in their natural environment after heavy rains.

MATERIALS

For each group of four students:
- terrarium or a large jar with a wide mouth
- dark paper to cover the sides of the terrarium
- masking tape



2 gallon terrarium



home made terrarium

large, open mouth jar

ADVANCE PREPARATION

Each group will need a terrarium or a large jar with a wide mouth. Terrariums like those used in Activity 16 are good ones to use. Look at the TEACHER AIDS-TERRARIUMS on page 87 for more terrarium ideas.

TEACHING SUGGESTIONS

First Day-What Kind of Environment Do Earthworm Live In?

1. Have a class discussion about earthworms:

   "Where do earthworms live?"

   "Do you know a place where we can find some?"

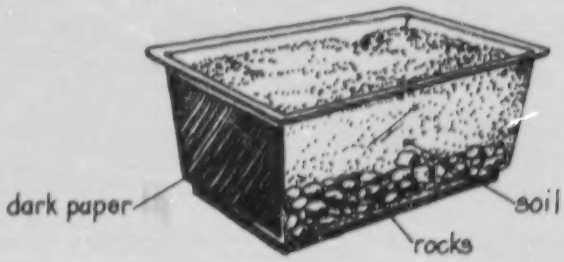
   "We will make a good environment for the earthworms in our terrariums. How can we make each of the environmental factors the best for the earthworms (optimum range)? What shall we do about the: soil, light, temperature and water?"

2. Decide where the class can find earthworms tomorrow. Plan to go get earthworms and soil tomorrow. Someone from each group will need some kind of digging tool.

3. Draw a terrarium on the chalkboard.

   "Each group will put an inch of small rocks on the bottom."

   "We will cover the sides with dark paper."



   "Tomorrow you can add the earthworms and soil."

4. Divide the class into groups of four students each. Give each group a terrarium.

   Let each group:
   put the rocks in its terrarium.
   put dark paper on the sides of its terrariums, and
   put the students' names on the terrarium.

Second Day-Getting The Earthworms

1. Before the students go to get the earthworms be sure they understand:

   They should not harm the earthworms.

   They should not try to scare other students with the earthworms.

   They should put the soil into the terrarium from where they find the earthworms.

   They should mix some decaying plants (humus) with the soil.

2. Let each group take their terrariums and get the earthworms and soil.

3. The soil should be slightly damp. Each day add enough water to keep the soil damp.

Third and Fourth Day-Observing The Earthworms

1. Let the groups observe their terrariums. They should take the paper off the terrariums while they observe and put it back on at the end of the lesson.

2. Discuss the observations:

   "Can you see the earthworms? What are they doing?"

"How do they move?"

"What do earthworms do to the soil? How does this help the soil?"

3. The students can feed the earthworms small pieces of plants. Mix the pieces gently in the top layer of soil.

Fourth Day-Flooding The Earthworms

1. Tell the class they will flood the terrarium soil to see how the earthworms respond. This is the same thing that would happen to the soil if it rained very hard.

2. Let each group add water to the terrarium until it is flooded to the top of the soil.

3. Observe the terrariums to see how the earthworms respond.

   Discuss the observations.

4. Remove the water from the terrarium by pouring it out.

Later Days-Observing And Doing More Experiments

1. The class can keep the earthworms if they are still interested in observing them.

   The class may do other experiments with the earthworms.

   Here are some sample questions and experiments:

   "How do earthworms respond to dry soil?"

   "How long can an earthworm live in a jar of water?"

   "Do earthworms use the same tunnel again?"

   "Would an earthworm let an insect in its tunnel?"

   "What does an earthworm do with the soil that was in its tunnel?"

   Take an earthworm out of the soil and observe its movement. Look at it with a magnifier.

   Shine a flashlight on an earthworm. "How does it respond?"

   Put some soil on paper near an earthworm. "Does it move toward the soil?"

2. After the class is finished observing, put the soil and earthworms outside.

   Clean up the terrariums.

AN ENVIRONMENTAL FACTOR!!!!!

Originally created and illustrated by Douglas Rankin
Re-illustrated for this publication by Felipe Figueroa

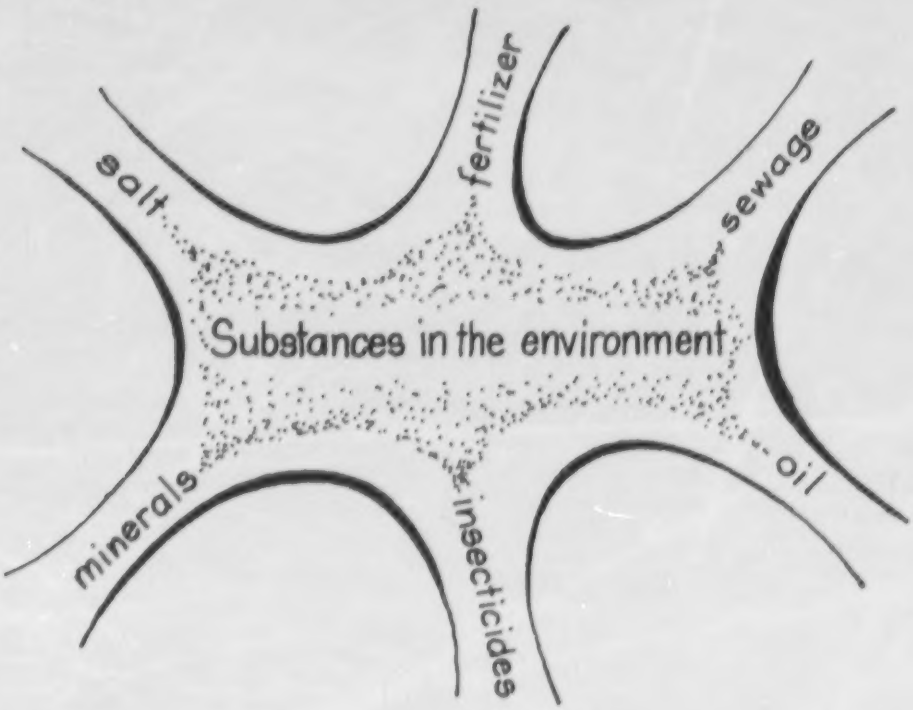
PART 5

SUBSTANCES IN THE ENVIRONMENTS

OBJECTIVES (WHERE PART FIVE IS GOING)

At the end of Part Five the students should be able to refer to their experiments and:

- Describe the responses of the organisms to certain chemicals in the environment.
- Describe the optimum range of the chemicals as an environmental factor.



ACTIVITY 13 BRINE SHRIMP IN SALTWATER

SYNOPSIS (WHAT WILL YOU BE DOING?)

The students experiment with brine shrimp eggs where the only variable is the amount of salt in the water. They compare their observations on a class chart. From the data on the chart they try to determine the salt concentration in which the eggs hatch best (optimum range).

OVERVIEW OF THIS ACTIVITY (WHY ARE YOU DOING THIS?)

There are many environmental factors in any organism's environment. Some of these factors are easily seen like temperature, water and, light. Some are harder to see, like how the salt concentration affects the hatching of the brine shrimp eggs. This activity is an example of how the concentration of chemicals in the environment affects organisms.

Examples of chemicals affecting saltwater organisms can be found in Micronesia. The poisoning of fish around the agriculture station in the Truk lagoon, the sewage in the Saipan lagoon, and the chemicals that could be released from sunken ships in Truk are all examples.

MATERIALS

For each group of four students:
- five small jars or vials
- small plastic spoon for measuring out salt
- small piece of wood (tooth pick size) for measuring out eggs

For the class:
- salt
- brine shrimp eggs
- masking tape
- chart paper
- large glass or plastic container for water

TEACHING SUGGESTIONS

<u>First Day-Deciding On An Experiment</u>

1. Tell the class: "There are many factors that organisms respond to. Besides light, temperature and water they respond to chemicals in their environment."

   "One chemical in the environment is salt. Salt in water is called saltwater and is like the ocean water."

2. Show the class some brine shrimp eggs:

   "These are brine shrimp eggs. They hatch in saltwater."

   "The amount of salt in the water may affect how many eggs hatch."

3. Let the class discuss how they could set up an experiment to see what amount of salt is best for hatching the brine shrimp eggs.

   Any experiment the class decides on should have these things always the same:

   amount of eggs in each jar,
   amount of water in each jar, and the
   place where you put the jars.

   Any experiment the class decides on should have only one variable. For each group the amount of salt in each jar should be different.

4. If the class decides on their own experiment, let them do it. If the class needs help and ideas for an experiment. Here is <u>one way</u> you could do the experiment.

Suggested Experiment:

a. Divide the class into groups of four students each. Each group does the experiment.

b. Each group will set up five jars. Each jar has different amounts of salt in it. The water and amount of eggs in each jar is the same.

c. The jars would be labeled and put in a safe place for two days.

d. After two days the experiment should be observed and recorded on a chart.

one toothpick full of eggs for each jar
same amount of water in each jar
level spoonful
Different number of spoonfulls of salt in each jar

Second Day-Setting Up The Experiment

1. If the students made up their own experiment, let them do it now.

   If the class is using the Suggested Experiment, let them do it now.

2. After the experiments are set up, put them in a safe place. Do not put them in direct sunlight. Put all the jars the same place.

3. Plan to observe the jars two days later.

Observation Day-Observing, Recording And Discussing

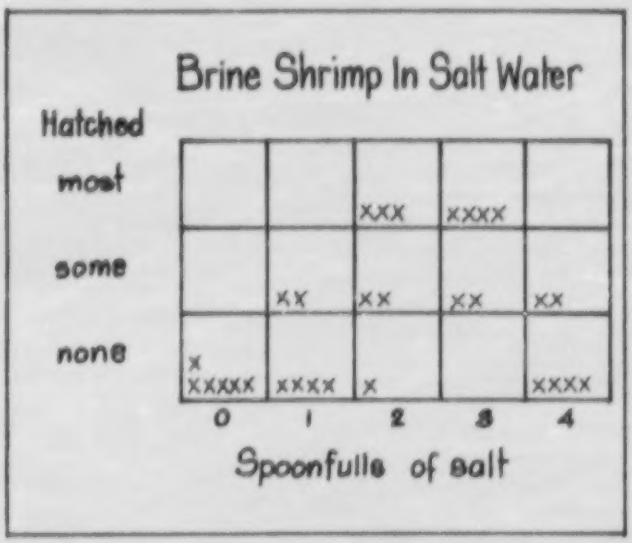
1. Let each group get their jars and observe how the eggs are hatching.

2. Each group should decide how many eggs are hatching in each jar. They should decide if NONE, SOME, or MOST of the eggs hatched in each jar.

3. Put up the chart paper and make a chart like the example. The units on the chart should agree with the units used by the class.

4. Ask each group to report how many eggs hatched in each jar - NONE, SOME, or MOST.

   Record their answers on the chart using Xs. Put an X in the correct box for each jar.



5. Discuss the chart:

   "Which amounts of salt were best for hatching the eggs? These amounts would be called the optimum range."

   "Are there any amounts of salt where the eggs would not hatch?"

   "In what type of environment would you find brine shrimp?"

   "Do you think more eggs will hatch tomorrow?"

6. Let the class decide what to do with the experiments. They could: observe the eggs for several more days to see if more will hatch,
do other experiments with the brine shrimp, or
clean up the experiments now.

OPTIONAL ACTIVITY - TOAD EGGS AND SALTWATER AS A POLLUTANT

You can do the same type of experiment with toad eggs as with brine shrimp eggs.

"Where can toad eggs be found?"

"Would they hatch in saltwater like in the ocean?"

"What would happen if some ocean water got into the place where toad eggs were hatching?"

Put toad eggs in water that contains different amounts of salt. Set up, observe, record and discuss the experiment like the one for brine shrimp.

OPTIONAL ACTIVITY - PLANTS AND SALTWATER

How do plants respond to different amounts of salt in water? This is an important question in many places in Micronesia because of salt spray from the ocean and waves washing up during a storm.

Let the students try experiments where they put water containing different amounts of salt on plants. They could grow the plants in the classroom or go outside and experiment on plants outside.

"How do plants respond to being watered with water containing one spoonful of salt each day? Two spoonfuls? Three spoonfuls? Ocean water?"

"Do all types of plants respond the same way to saltwater?"

"What plants do you predict would grow best in a saltwater environment?"

"Does saltwater harm any food plants like taro?"

"What plants do you find growing near the ocean? Do you find them in other places also?"

ACTIVITY 14 PLANT RESPONSES TO FERTILIZER

SYNOPSIS (WHAT WILL YOU BE DOING?)

The class use different amounts of fertilizer on seeds. The observe and record the growth of the plants from the seeds. From this they decide on an optimum range of fertilizer.

OVERVIEW OF THIS ACTIVITY (WHY ARE YOU DOING THIS?)

The students explore the use of fertilizer as an environmental factor. This is an activity that could be closely related to the student's experience at home growing things.

MATERIALS

For each group of five students:

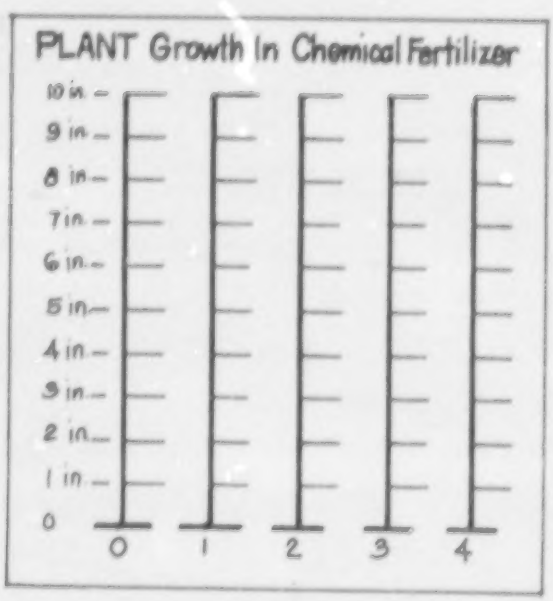
- ten bean seeds (any fast germinating seed may be substituted)
- five cans - all the same
- plastic spoon
- medicine dropper
- ruler
- jar of water

For the class:

- soil
- masking tape
- chart paper
- chemical fertilizer (mixture of animal manure and wood ash would be used as a substitute)
- chart paper

ADVANCE PREPARATION

Make a PLANT GROWTH IN CHEMICAL FERTILIZER chart like in the picture.



TEACHING SUGGESTIONS

First Day-Discussing The Experiment

1. Have a class discussion:

   "What can you put on plants to make them grow best?"

   "Did you ever use fertilizer?"

   "Why do people use fertilizer?"

   "What kinds of fertilizer have you seen?"

2. Show the class the chemical fertilizer.

   Tell them that this is a chemical that can be added to the soil. It will change the plants' environment.

   Discuss other fertilizers that can be used. For example:

   animal manure
   ashes
   rotting leaves and pieces of plants
   dead animals (sea cucumbers, fish)

3. Tell the class they can set up an experiment to see how plants respond to the chemical fertilizer.

   They could also set up experiments to see how plants respond to other kinds of fertilizer.

   Each group will set up five cans. Each can will have soil and two seeds in it.

   Draw this on the chalkboard for the class.

4. Discuss the factors in the experiment that should be the same for each can: kind of soil, amount of soil, where you put the cans, how deep you plant the seeds, the amount of water put in each can.

   Discuss the factor in the environment that will be different for each can: the amount of fertilizer.

5. Show the class a spoon. Explain that this will be used to measure the chemical fertilizer for the cans.

one can will get 0 spoonfuls of fertilizer
one can will get 1 spoonful of fertilizer
one can will get 2 spoonfuls of fertilizer
one can will get 3 spoonfuls of fertilizer
one can will get 4 spoonfuls of fertilizer

Put this on the chalkboard for the class.

6. Divide the class into groups of five students each.

   Let the class decide on the following:

   How much soil will you put in each can? They must all be the same.

   How deep will you plant the seeds? They must all be the same.

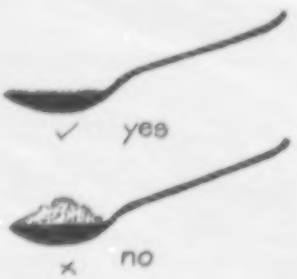
   Where will you put the cans? They must all be in the same place.

   How much water will you put on the plants and what days will you do it? The amount and time must be the same for all cans. For example: they could put five droppers full of water on each plant every Monday, Wednesday and Friday.

   How will you mix the soil and fertilizer? It must be mixed well.

Second Day-Setting Up The Experiment

1. Be sure each groups understands that it will set up one complete set of cans. The students must be careful to get the correct amounts of fertilizer in each can. The fertilizer must be mixed with the soil. A spoon is full if it is level, not heaped up.



2. Give each group their materials:

five cans	soil
ten seeds	can of water
plastic spoon	masking tape
medicine dropper	fertilizer

   Let each group set up its experiment.

   Each can should be labeled with the student's name and correct amount of fertilizer mixed with the soil.

   Put the cans in the same place.

During The First Week-Watering The Plants

Give the students time to water their plants. Use the schedule the class decided on. For example: each can will get five droppers full of water every Monday, Wednesday and Friday.

End Of The First Week-Observing And Recording

1. Let each group get its cans and observe for plant growth.

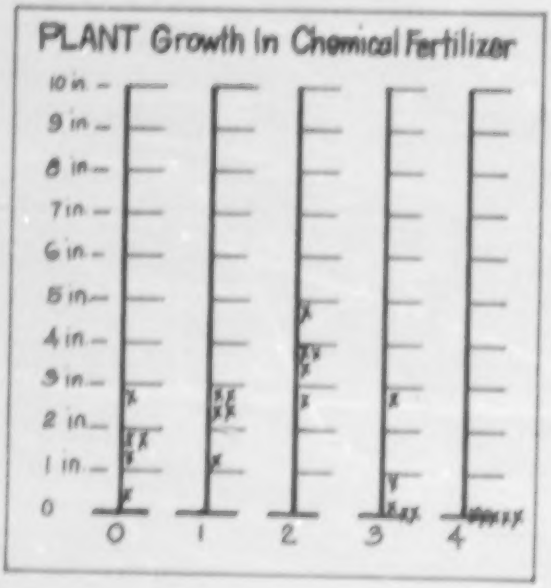
   Each student should measure the plant in his can. If there are two plants in the can, measure the tallest one. Some cans may not have any plants.

2. Put up the PLANT GROWTH IN CHEMICAL FERTILIZER chart.

   Ask all the students with cans of 0 spoonfuls of fertilizer to report their measurements. Put an X on the chart for each student's measurement.

   Ask all the students with cans of 1 spoonful of fertilizer to report their measurements. Put an X on the chart for each student's measurement.

   Do the same thing for the students with the 2, 3, and 4 spoonfuls in their cans. Record the measurements on the chart.



3. Discuss the chart:

   "Is there any difference between the plants?"

   "What do you predict is causing any differences?"

   "What do you predict the changes will be by next week?"

During The Second Week-Watering The Plants

Continue watering the plants according to the schedule.

End Of The Second Week-Observing And Recording

1. Let each group get its plants and observe for plant growth.

Each student should measure the plant in his can. If there are two plants, measure the tallest one.

2. Look at the PLANT GROWTH IN CHEMICAL FERTILIZER chart.

   Ask the students to give their measurements. Record the measurements using a different colored marker than the first time.

3. Discuss the chart:

   "Which plants changed most since last week?"

   "Which plants are growing the best?"

   "Do the plants need the chemical fertilizer to grow?"

   "What would you predict for a plant with 8 spoonfuls of fertilizer?"

   Let the class decide which concentration of fertilizer the plants are responding to best. Is it 0, 1, 2, 3 or 4 spoonfuls? This would be the optimum range of fertilizer concentration for these seeds. Discuss this with the class.

   "How do the plants respond to chemical fertilizer?"

   "What do the experiments tell us?"

   "Are there other experiments you would like to do with fertilizer?"

4. Let the students decide what to do with the plants. They could:

   continue the experiment for another week,

   plant the plants outside,

   take the plants home,

   think of new experiments to use them in, or

   throw them away.

OPTIONAL ACTIVITY - LOCAL FERTILIZERS

Find out what local farmers use as fertilizers. Try experiments with some of the local fertilizers.

Talk to the agriculture department about local fertilizers and chemical fertilizers.

ACTIVITY 15 SNAILS AND SALTWATER

SYNOPSIS (WHAT WILL YOU BE DOING?)

Land snails are put inside a paper barrier soaked with saltwater. The students observe the snails' response to crossing the barrier. Other experiments concerning the snails' response to barriers and other substances are encouraged.

OVERVIEW OF THIS ACTIVITY (WHY ARE YOU DOING THIS?)

This activity allows the organisms to move in response to the chemical substance. The students can observe an organism that can respond to chemical substances by escaping.

MATERIALS

For each group of two students:
- small jar or can of water
- paper towel or strips of paper
- salt (you can use ocean water in place of this salt and freshwater)

ADVANCE PREPARATION

If there are many snails around the school, the students can get them on the First Day. If snails are hard to find, you or the students should bring some to school for the First Day.

TEACHING SUGGESTIONS

<u>First Day-Observing How Snails Respond To Saltwater</u>

1. Have a class discussion: "How do land snails respond to water?"

   "How do land snails respond to saltwater?"

2. Tell the class they can find out how land snails respond to saltwater.

Draw the diagram of the paper barrier triangle on the board.

"You can lay down three strips of paper like this."

"Then add saltwater to the paper. Keep the middle of the triangle dry."

"Put the snail in the center and observe his movement."

3. Divide the class into groups of two students each.

   Let each group go outside and find a snail.

4. Give each group a paper towel, some salt and a jar of water.

   Let them set up the saltwater soaked barriers and observe the snails. They may have to observe the snails for a long time. The snails may move slowly.

5. At the end of the lesson, cleanup the paper and water. The snails can be kept for later.

Second Day-How Did The Snails Respond?

1. Have a class discussion: "Do snails respond to saltwater? What is your evidence?"

   "Do you think the snails would cross the paper if it were soaked in freshwater? How could you find out?"

   "How can a snail avoid chemicals like saltwater in its environment?"

   "What response do you predict a snail would have to:

   sugar water,
   freshwater,
   fertilizer in water,
   dry sand and wet sand.

2. Let the class decide on other experiments they could do to answer questions on how snails respond to different chemical substances in the environment.

   Let the students do their experiments.

OPTIONAL ACTIVITY - PHYSICAL BARRIERS FOR SNAILS

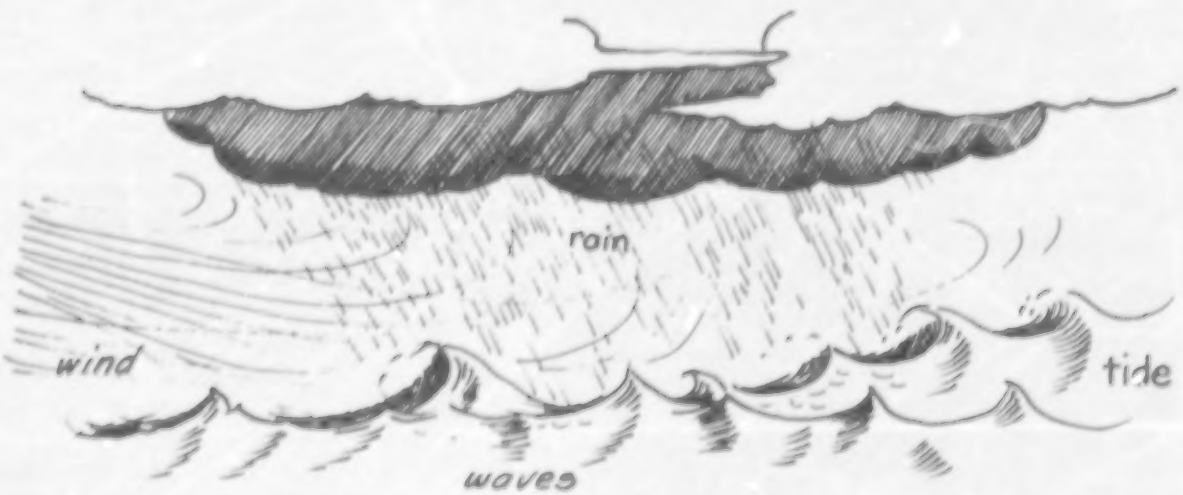
Keeping snails out of gardens and farms is sometimes difficult. What kinds of barriers (fences) keep snails out? Let the students design different barriers and experiment to see if snails can get over them. The barriers could be tested inside the classroom or by making the barriers outside.

PART 6 THE TOTAL ENVIRONMENT

OBJECTIVES (WHERE PART SIX IS GOING)

At the end of Part Six the students should be able to:

- Select an organism and experiment with environmental factors to allow that organism optimum ranges of these factors.
- Describe some of the changes in the island environment that occur over a period of time.



"Changes"

ACTIVITY 16 SETTING UP AN ENVIRONMENT

SYNOPSIS (WHAT WILL YOU BE DOING?)

The class considers the environment of the ant. The students plan to set up the best environment they can for a colony of ants. Each group gets an ant colony from outside and puts it in their terrarium. They follow their plan to make the environment the best for the ants (optimum range for most factors).

OVERVIEW OF THIS ACTIVITY (WHY ARE YOU DOING THIS?)

This activity allows the students to use their experience to set up an environment where the environmental factors are mostly within the optimum range. The organism used is the ant. Ants are very common, but have not been used in other activities. The students should be very interested in setting up and observing an ant colony.

MATERIALS

For each group of four students:
- terrarium with lid or homemade wood and plastic ant farm terrarium
- several cans to dig with
- several sheets of dark, thick paper to cover the sides of the terrarium

For the class:
- chart paper
- masking tape

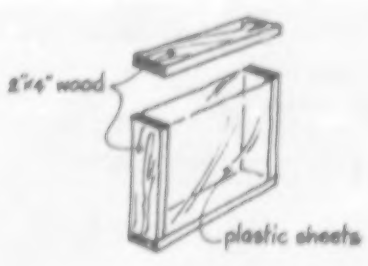
ADVANCE PREPARATION

You will have to cover the holes in the lid if you are using two gallon terrariums. You could stick cloth in the holes. This will keep the ants in the terrarium.

You may wish to build several of the terrariums like in the picture. You need the following to build one:

Two pieces of plastic about 8½ inches X 10½ inches. Overhead transparency, plastic sheets work fine.

Pieces of 2" X 4" wood. Two pieces, each 10½ inches long, for the top and bottom. Two pieces, each 7½ inches long for the sides.



This ant farm, terrarium works well because it is easy to cover the sides with dark paper.

The TEACHER AID on TERRARIUMS on page 87 will give you many ideas for different terrariums.

TEACHING SUGGESTIONS

First Day-Discussing Setting Up An Environment

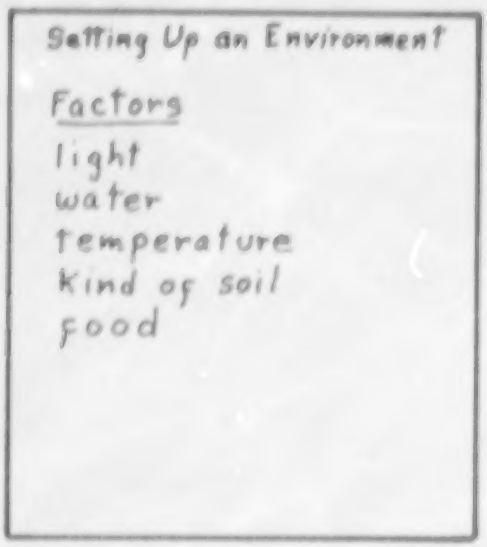
1. Tell the class that they can set up an environment for ants.

   Discuss the environmental factors that affect ants and the optimum range of these factors:

   "Where can you find ants?"

   "What are the environmental factors in the ants' environment?"

   List the environmental factors on the chart paper as the students name them.



2. Show the class the terrariums.

   Discuss how the ants in the terrariums can have the best environment (optimum range) for them to live in.

3. Divide the class into groups of four students each. Let each group plan what they will do tomorrow with their terrariums.

Second Day-Setting Up The Terrarium

1. Each group should know:

   Find the ant colony and dig out as much off it is possible. The more ants you get from in the colony the better the colony will be inside the terrarium.

   Put the ants and soil in the terrarium. Fill in almost to the top. Then cover the sides of the terrarium with black paper. The ants will build their tunnels by the side if it is dark. Then you can take the covers off to observe the ants in their tunnels.

2. Give each group its terrarium and some cans to dig with.

   Let the students go outside and dig up an ant colony for their terrarium.

3. After they get the ant colony they should tape dark paper to the sides of their terrarium.

Third Day-Observing The Terrarium

1. Look at the SETTING UP AN ENVIRONMENT chart.

   Have a class discussion: "Are the environmental factors in optimum range best for the ants?"

   "How will you make an optimum range for each factor?"

2. Let each group get its terrarium.

   Remove the dark paper from the sides and observe the ants.

   Put the paper back on the sides after the observation.

Later Days-Observing, Discussing And Experimenting

1. Let the students observe and discuss:

   "Are the ants in each terrarium the same kind?"

   "Do different kinds of ants live in different environments?"

   "What foods do the ants eat?"

   "Are all the ants in the colony the same?"

   "Can you find something about ants in books?"

   "What environmental factors are the same in your terrarium as when the ants were outside?"

   "What environmental factors are not the same in your terrarium as when the ants were outside? Can you make them the same?"

2. Let the students do other experiments with their terrariums if they want to.

3. Cleanup the terrariums when the students loose interest in them.

ACTIVITY 17 RECORDING CHANGES (OPTIONAL)

NOTE ABOUT USING THIS ACTIVITY

You or the students may think it interesting to record environmental changes. If you want to do this, this activity gives ideas on how to do it and what to use.

You could start this activity, or parts of this activity, any time during the year.

SYNOPSIS (WHAT WILL YOU BE DOING?)

Students select factors in the environment to observe. They record the environmental changes over a long period of time (several months). They discuss how these environmental changes may be affecting organisms in the environment.

OVERVIEW OF THIS ACTIVITY (WHY ARE YOU DOING THIS?)

In this activity a point is made to try and connect environmental changes with an effect on organisms in that environment. This is pointing out possible cause and effect processes that the students may not have thought of before.

Seasonal changes are not as great in Micronesia as in other parts of the world. But, there are many environmental changes that do take place and things that are seasonal. People speak of the breadfruit season, mango season or of when certain kinds of fish can be caught. Islands have their dry and wet seasons, high and low tides, windy and calm seasons.

MATERIALS

The materials you use will depend on what you choose to observe. You will have to look at each "Suggestion" and decide what materials you will need.

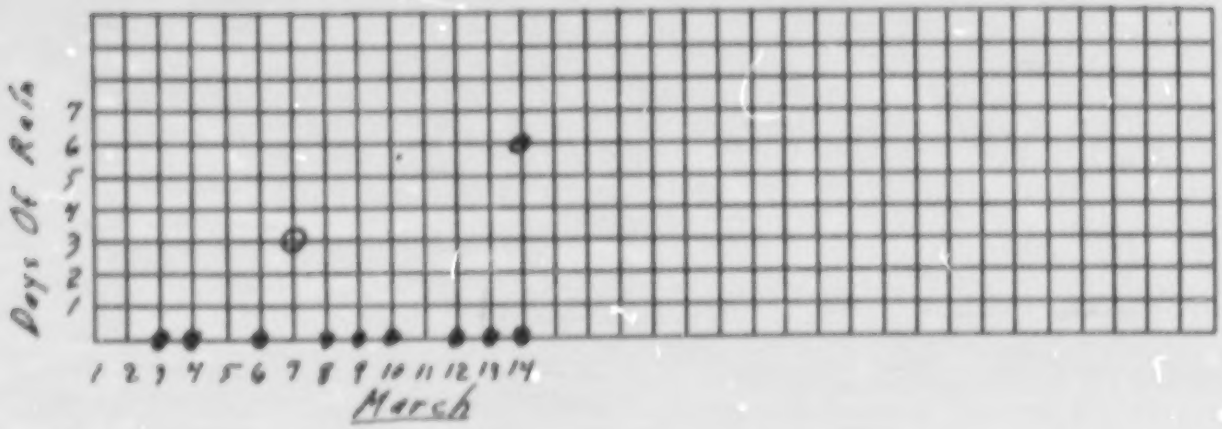
TEACHING SUGGESTIONS

You and the class decide which of the "Suggested Environmental Changes" to observe and record.

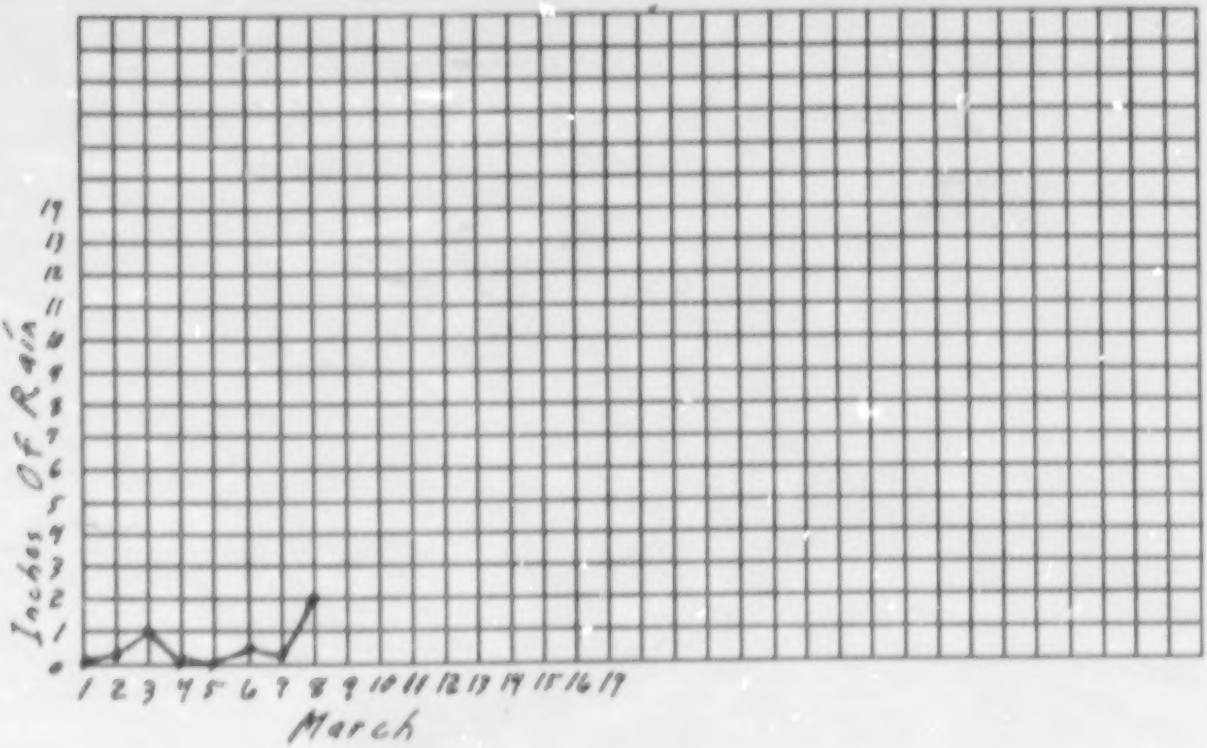
Suggestion #1 - Recording Rain

1. One way to record rain is to mark how many days it rained.

   At the end of each week mark the number of days it rained.



2. Another way to record rain is to measure how much rain comes down. To do this the class makes a rain gauge and measures how much water is in it each day. This is recorded on a chart.



Here is one way to make and use a simple rain gauge:

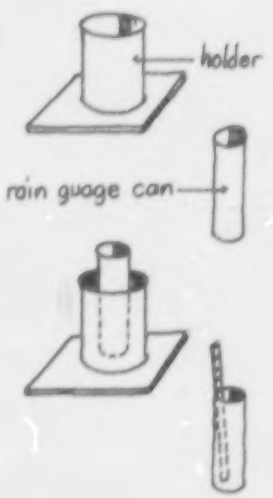
a. Nail a large (quart size) can to a board. This is to hold the rain gauge can so it will not fall over.

b. Make a rain gauge out of a smaller can like a Coke can. The can should have a flat bottom.

c. Put the rain gauge can into the holder. Place the holder and gauge in a place that is open to the sky.

d. Once a day hold a ruler up in the gauge can. Measure how deep the water is in the can. Record this on the chart.

e. Empty the can so it will be ready for the next day.



3. At the end of each month total up the number of days it rained or how much rain came down.

Discuss: "Which months had the most rain? The least?"

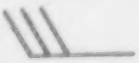
"How did the different amounts of rain affect plants on the island? Animals?"

"How did the different amounts of rain affect what people have to eat?"

"List the animals that you see more of in the wet time of the year."

Suggestion #2 - Recording Wind Using Your Senses

1. The following chart can be used by the students to estimate wind speed.

Wind Effects Observed on Land	National Weather Service Symbol	Terms used in Forecasts	Miles Per Hour
Calm; smoke rises vertically Direction of wind shown by smoke drift; but not by wind vanes		Light	1-3
Wind felt on face; leaves rustle; ordinary vane moved by wind			4-7
Leaves and small twigs in constant motion; wind extends light flag		Gentle	8-12
Raises dust; loose paper; small branches are moved		Moderate	13-18
Small trees in leaf begin to sway; whitecaps form on inland waters		Fresh	19-24
Large branches in motion; whistling heard in electric wires; umbrellas used with difficulty		Strong	25-31
Whole trees in motion; inconvenience felt walking against wind		Gale	32-38
Breaks twigs off trees; generally impeder progress			39-40
Slight structural damage occurs			47-54
Seldom experienced; trees uprooted; considerable structural damage occurs			55-63
Very rarely experienced; accompanied by widespread damage		Whole gale	64-74
Very rarely experienced; accompanied by widespread damage		Typhoon	75-136

The students observe how the wind moves objects they can see. They compare what they see with the Wind Speed Chart. The student can record the wind speed using the Weather Service symbol, the term or miles per hour.

The students can observe and record the wind speed each day on a chart.

2. The students can find the wind direction by standing so the wind is coming directly into their face. As they face into the wind they can read a compass to see what direction the wind is coming from.

   The wind direction can be recorded each day on a chart.

3. Discuss: "How does wind affect the plants on the island?"

   "How does wind affect the animals on the island?"

   "Is there more wind at some times of the year than at other times?"

   "Does the wind always come from the same general direction?"

   "How do very strong winds like typhoons affect the environment of the island?"

   "How does wind affect what man does? For example: When he goes out in boats, how he builds his house, where he plants his food."

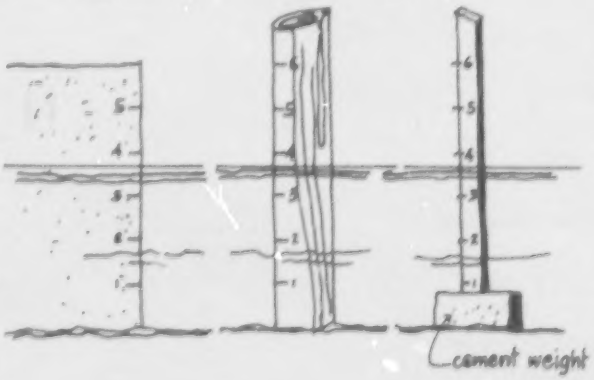
Suggestion #3 - Recording Tides

1. The students can record tide height. This could be done over a week or month at the same time each day. As a special experiment they could record it every hour for one day.

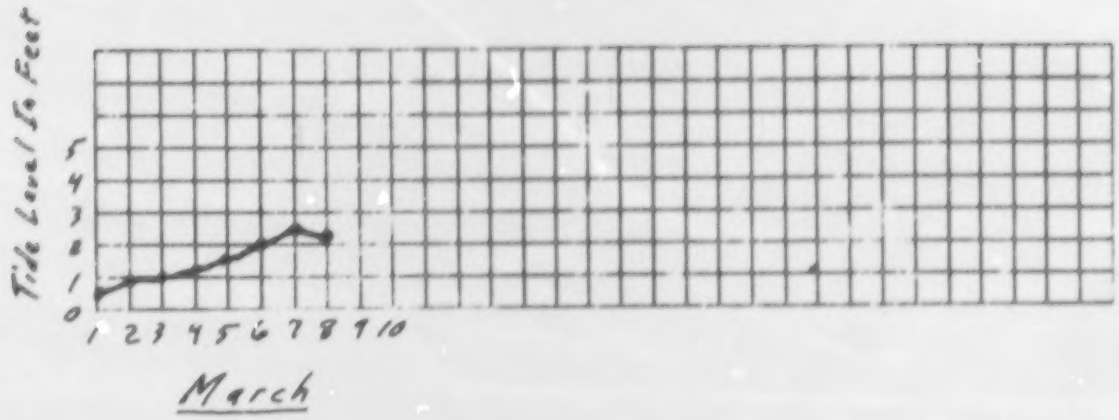
2. The class will need to find something to use in measuring the tide level.

   The easiest way is to find a post or wall in the water and mark it off in feet.

   If there is nothing in the water, the class could put a weighted post in. The post would be marked off in feet.



3. The daily measurements could be put on a graph like this example:



4. Discuss: "How much does the tide change? How many feet?"

"How does the changing tide affect the organisms at the waters edge?"

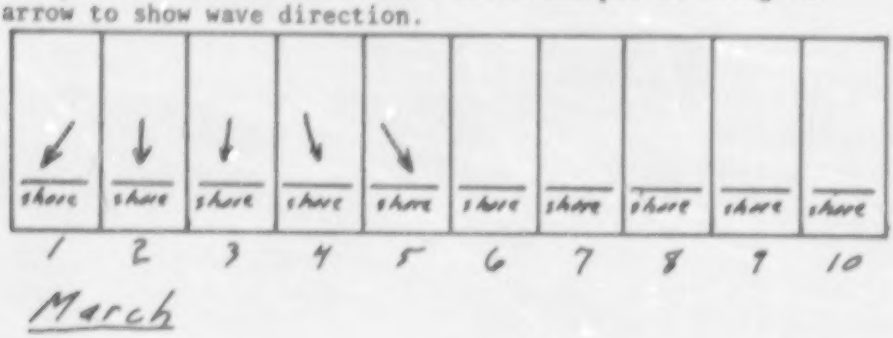
"How does the changing tide affect man?"

"Is the fishing better during any special tide level?"

"How many times a day does the tide go up and down?"

Suggestion #4 - Recording Wave Action

1. The class can select one place to observe wave action. At this place they can observe the direction the waves are coming and put this on a chart. Here is an example of using an arrow to show wave direction.



2. The class may be able to estimate how high the waves are and record this. This could be done if there is a large rock or other obstacle where the waves are breaking. This would give them something to refer the height to.

3. The time between waves can be measured. The students can see what number they can count to between waves.

4. Discussion: "How do waves affect the beach?"

   "Do waves always come in the same direction?"

   "What do the local people know about waves?"

   "How do waves affect man?"

   "Does wave action change during the year?"

HOW TO TAKE A FIELD TRIP

Some of the most important learning experiences are outside the classroom. A field trip experience is just as important as classroom experience. It is usually more important than classroom experience.

A field trip should be an enjoyable learning experience for the students and the teacher. The three most important things in making it a good field trip are:

THE TRIP MUST BE WELL ORGANIZED.

THE PURPOSE OF THE FIELD TRIP MUST BE UNDERSTOOD BY EVERYONE.

ALL CHILDREN MUST UNDERSTAND THEIR RESPONSIBILITIES WHILE ON THE TRIP.

Here are suggestions to help you have a good field trip:

What should you (the teacher) do BEFORE you take the field trip?

Discuss the field trip with the principal and get his permission.

Be sure you know the place you are going to. If you have never been there, go check it out before the day of the trip.

Get permission from the owners before going on private land.

Contact people who will be guiding you or helping you. It is best to have one adult (teacher or parent) to go with you on the trip.

Get parental permission forms for each child. Do this if it is the policy of your school or for your own use.

If you will be using transportation, get the transportation arranged one week before taking the trip.

If you need transportation, arrange it one week before the day of the trip. On the day before the trip check the following: is the transportation confirmed, does the driver know the time and place to come to your school.

What should the class do BEFORE the day of the field trip?

They should know the purpose of the field trip. Discuss this in class. Discuss with the class their responsibilities. This means they know what they will be doing and what the rules are.

Tell them the kinds of clothing to wear on the trip.

If you need some special materials for the trip, the class should get it ready. For example: jars for catching things, nets, record books.

What are some good field trip rules?

The children should know the boundaries they must stay in on the field trip. They should not go outside of these boundaries. For example: You should show them the part of the beach they can work on. They should not go to another place.

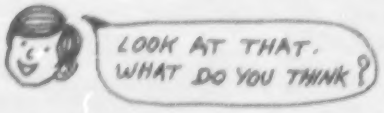
The class should leave and enter the school grounds in a quiet orderly manner.

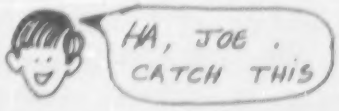
Explain things they should not do or places they should not go because it is dangerous. Examples of such SAFETY RULES are:

> "Stand in the place the teacher says inside the generator plant. No pushing or running inside the building."
>
> "Do not go into water over your head. Only go in the place the teacher says."

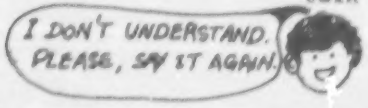
Nobody wants children to come to their place if the children are shouting, pushing, running or playing games. The children should be orderly and talk, but not shout, when they are at the place for the field trip.

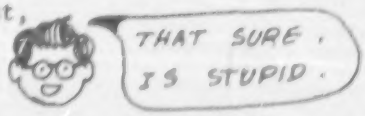
The children should:





talk but do not shout,





ask questions but be polite,

look at things but do not destroy things,

How long should a field trip be?

Only go to the place you planned to go to. If you are going to the beach to catch organisms, do that. Do not stop at other places. If the children are interested in other places, go to these other places on another field trip.

The children will get too tired if you try to do too much. A well planned field trip of one hour is long enough. Special trips using a long bus trip may take longer.

What does the class do after the field trip?

You might discuss the field trip in class the same day. Maybe you will have to wait until the next day to discuss the field trip.

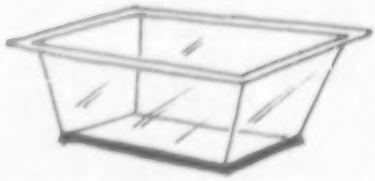
Let the class write a "thank you" letter to the people at the place you visited and the bus driver.

TERRARIUMS

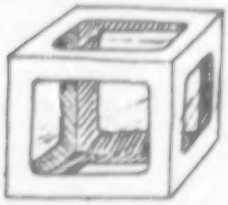
Below are examples of different kinds of terrariums. Some are commercial and some you can make yourself. The kind of terrarium you need depends on what you want to do.

one gallon aquarium used as a terrarium

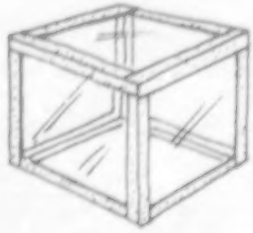
two gallon terrarium



larger aquarium used as a terrarium



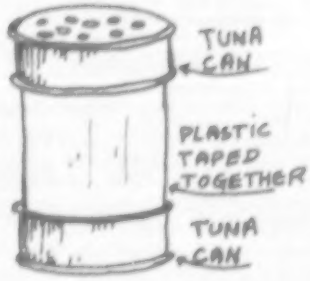
overhead transparency terrarium made from six mounted overhead transparencies



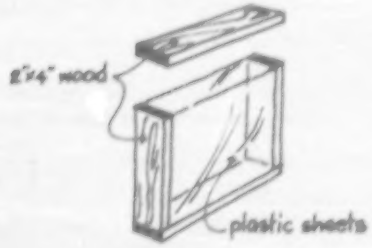
six pieces of glass or plastic taped together or glued together with Silastic

large jar with a lid or screen over the top

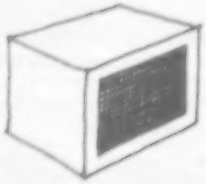
plastic cups taped together



cans and plastic or cans and screen



wood frame and plastic sides-good for ant farms



box with screen

screen or fine wire fence made into a cage

GLOSSARY

environment	The combination of all external factors that affect and influence the growth, development, and reproduction of organisms.
environmental factor	Any part of the environment, such as chemicals, water, or light, that affects organisms and to which they respond.
fertilizer	An artificial or natural source of minerals used by plants.
germinate	To begin to grow; to sprout.
larva	The first stage after hatching of any animal that undergoes metamorphosis, such as the tadpole. In insects the larval form is often wormlike.
optimum range	That part of a range of an environmental factor in which an organism lives best. (See range).
organism	An individual living thing; any plant or animal.
population	A group of organisms of the same kind living and reproducing in a particular area. Population size is determined by the number of individuals in the group and not by the physical size of the individuals.
range	All the intensities of an environmental factor between a minimum and a maximum. A range in the amount of water may be from dry to soaked. (See optimum range.)
terrarium	A container in which land organisms can live.

ENVIRONMENTS MATERIALS NEEDED FOR ONE CLASSROOM FOR ONE YEAR
(Based on 32 students per class)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total
KIT-RETURNABLE	terrarium	8											8				8		8
	terrarium lid	8															8		8
	thermometer							16	16	16									16
	medicine dropper											7			7				7
KIT-CONSUMABLE	student worksheets	32	32	32	32		32	32	32	32	32								288
	bean seeds*	32				64						70			70				236
	radish seeds*	32																	32
	corn seeds*	32																	32
	aluminum foil (6" x 18")				8														8
	salt													X		X			½pkg
	brine shrimp eggs													X					¼pkg
	chemical fertilizer														X				½ lb.
SCHOOL/TEACHER	masking tape	X			X	X			X			X	X	X	X		X		X
	cans	4				35			16						32		8		35
	small jars	X										37		40		16			40
	large jars													7	7				7
	plastic spoon											7		8	7				8
	ruler											7			7				7
	chart paper	1			1	3	1		1	1		1		1			1		11
	black paper (sheets)				8								16				16		40
	clear plastic (2" x 2")				8														8
	paper, ditto					4													4
	cardboard boxes					2													2
	soil					X						X			X				X
	scissors				X														X
	crayon					32													32
	toothpick													8					8
	paper towels															16			16

NOTE: * can be substituted for any local seeds that germinate quickly.